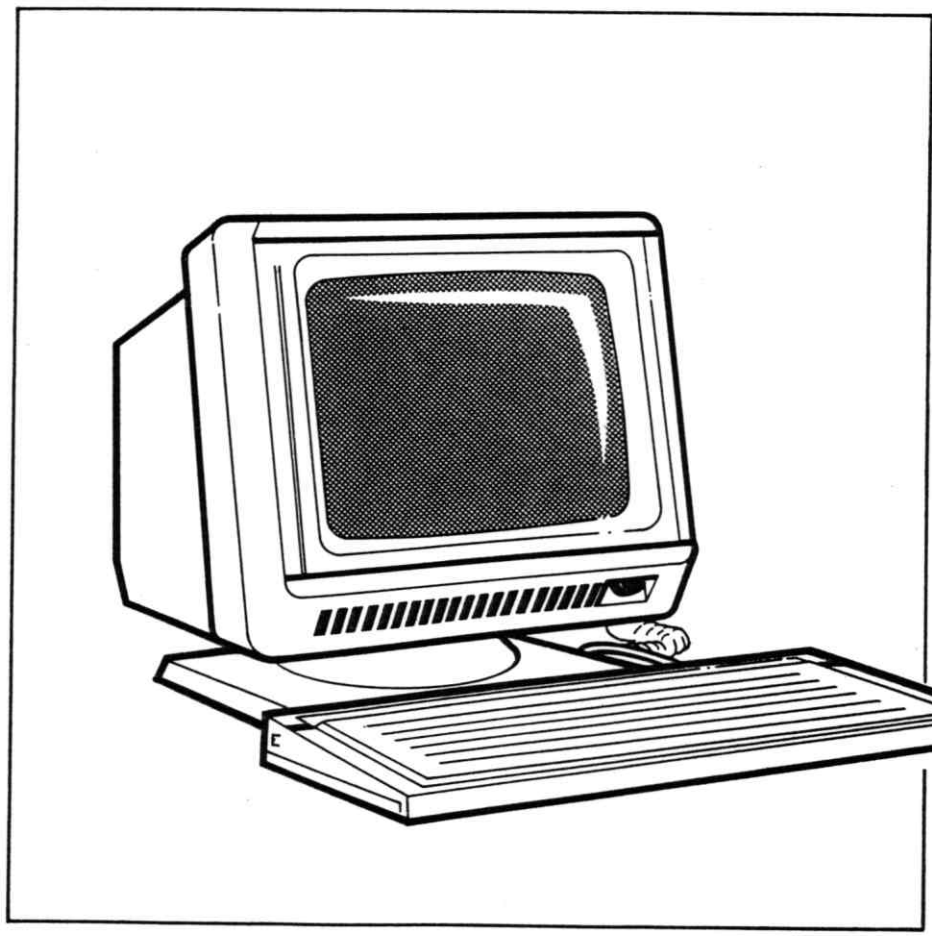
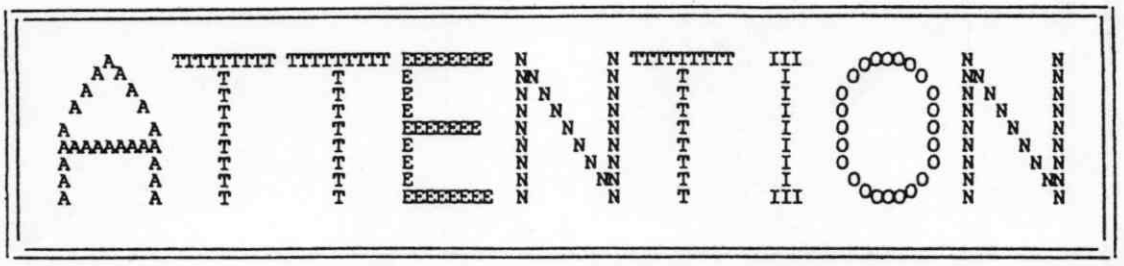
ICL 6402 G



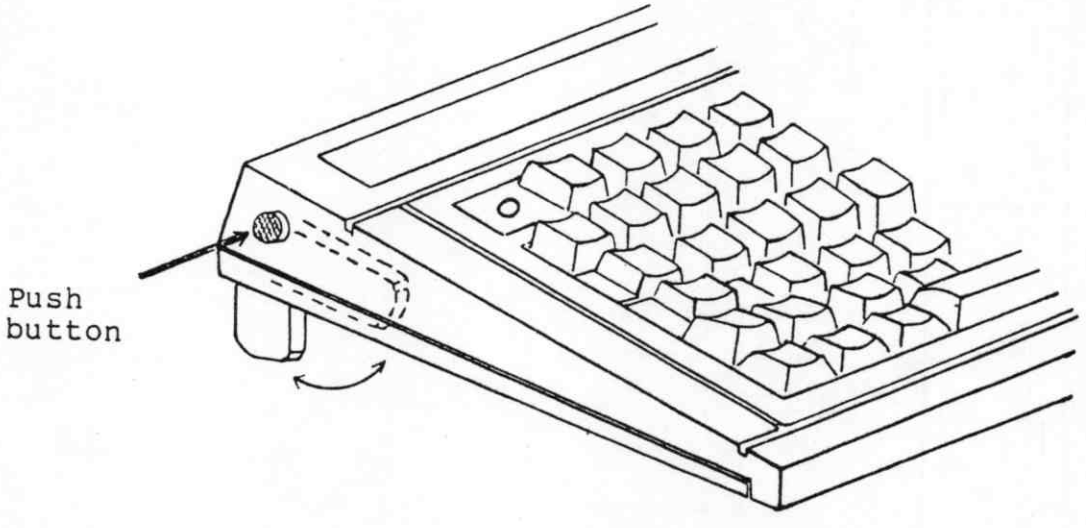
User Guide



***** S T O P *****

Do not fold the tiltable feet of the keyboard without pushing buttons on both sides of the keyboard.

When fold the tiltable feet, push the buttons on both sides of the keyboard.



212-0190-7

6402G CHARACTER DISPLAY
FUNCTIONS & OPERATING INSTRUCTIONS
MANUAL

Jun. 1985

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HANDLING

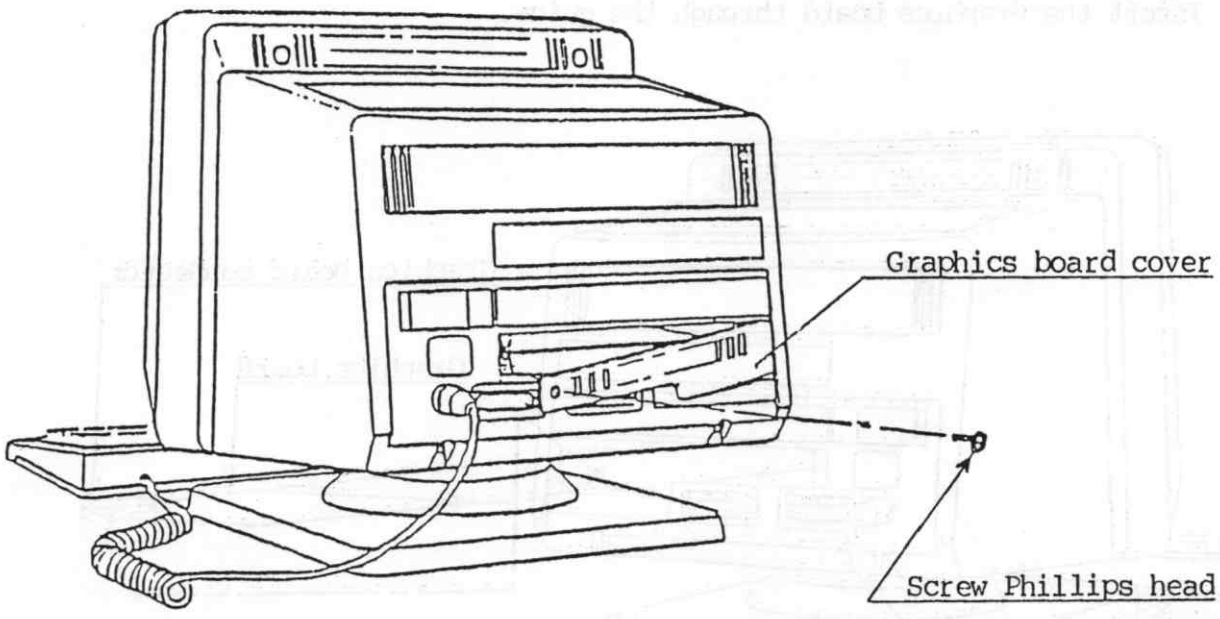
1. Installation

   (1) Open the cardboard box to take out the equipment. The display unit and the keyboard are packed together. First take out the keyboard.

   (2) Check on the accessories to see that all of the needed items are present. For a list of the components, see Page 1 of this manual.

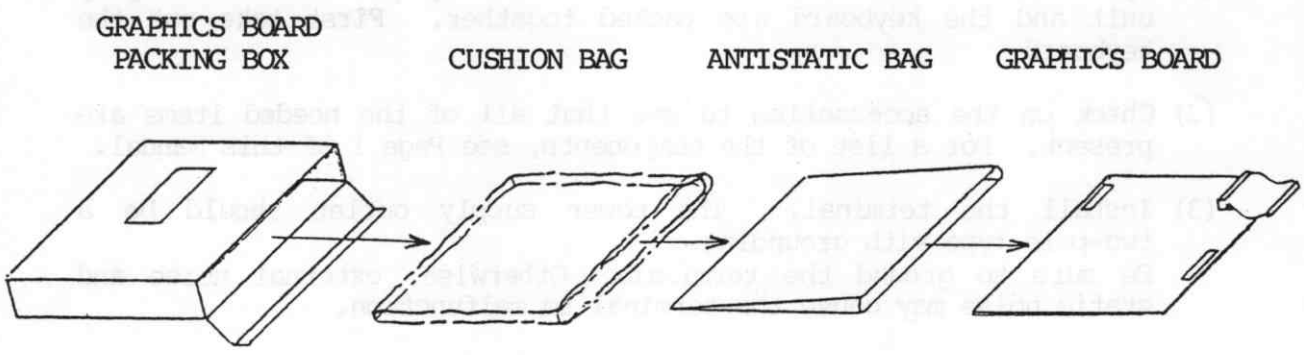
   (3) Install the terminal. The power supply outlet should be a two-pole type with grounding.
   Be sure to ground the terminal. Otherwise, external noise and static noise may cause the terminal to malfunction.

2. How to Install Graphics Board



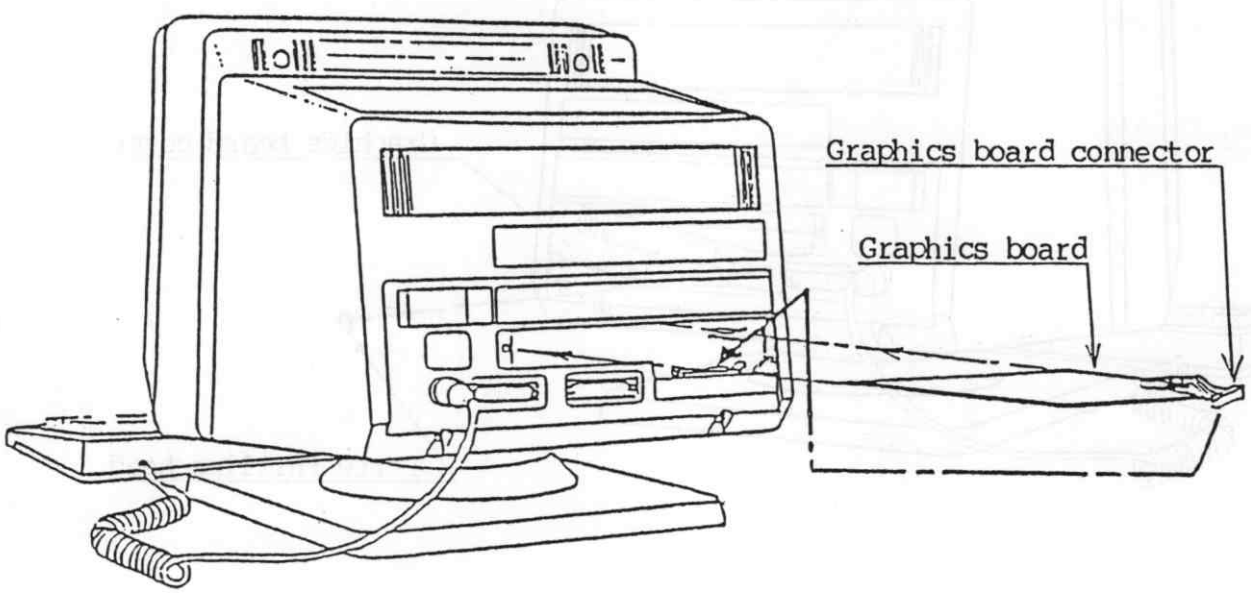
STEP 1
Remove Power from Terminal. (Isolate at Wall Socket)
Remove the Graphics board cover.

STEP 2
Open the Graphics board packing box, and take out the Graphics board as follows:



Note: Take care not to touch Components board.

STEP 3
Insert the Graphics board through the guide.



STEP 4
Insert the connector into the receptacle of the main PCB.
Take care not to touch Components on the Main PCB.

STEP 5
Replace Graphics board cover and tighten screw.

STEP 6
Power up unit.

3. Turning On the Power Switch

(1) Before turning on the power switch, remember to take the following steps:

a. If the settings of the system status information shown in section 2.5.4 page 14 are not appropriate for the purpose for which the terminal is to be used, set NVRAM information display mode (refer to section 2.5 page 10).
Then, set the status are required for the intended purpose.
After completing the setting, set normal running mode (refer to section 2.5 page 10).

b. Connecting the various connectors.

* Connect the keyboard to the connector marked KEYBOARD on the terminal.
* Connect the external interface to the connector marked HOST on the terminal.
* If a printer is to be used, connect it to the connector marked PRINTER on the terminal.
* If a mouse is to be used then connect it to the connector marked PRINTER on the terminal.
Fix each connector securely by turning the lock screw clockwise, using a flat-point screwdriver.
* Plug the AC power cable into the power outlet.

(2) Turn on the power switch on the rear panel.
The power turns on, the buzzer sounds for about 0.5 second, the terminal is now ready.

Note: This terminal may be used on IT Power Systems as it has dual Pole mains protection.

1. GENERAL DESCRIPTION

1.1 Introduction

The 6402G is a high-performance, microprocessor based video display terminal.
The 6402G has a sophisticated editing capability made possible using an ergonomically designed keyboard, a clear screen a facility for transfering data in block mode. The graphic option is designed to be the heart of a high-performance computer graphics.

1.2 General Specifications

1.2.1 Components

The machine consists of the following components:

Item No.	Component	Q'ty	Remarks
1	Keyboard	1	Slimline
2	Display unit	1	Main logic board CRT Monitor included Power supply
3	Functions & operating instruction manual	1	copy
4	Key top set	1	set
5	Key top removal tool	1	
6	Graphics board	(1)	(Option)

1.2.2 Basic Specifications

(1) CRT	12" diagonal with tilt and swivel cabinet
(2) Phosphor	P31 Green phosphor, Non-glare
(3) Screen format	24 lines x 80 characters plus 25th line
(4) Character format	7 x 11 dot matrix
(5) Character block	9 x 16 dot matrix
(6) Character set	128 character (ASCII) (96 alphanumeric + 32 control), 11 language support 16 special graphics. Additional 64 semi-graphics
(7) Screen attributes	Half intensity with protected fields, reverse video, underline, blink and blank plus combinations.

(8) Communications interface	RS232C, 20 mA current loop
(9) Communication modes	Half duplex or full duplex (keyboard selectable)
(10) Baud rates	Keyboard selectable: 50, 75, 110, 135, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600 19200 (max. 4800 for current loop)
(11) Parity	Odd, even, no parity, mark, and space (keyboard selectable)
(12) Word structure	7 or 8 data bits, 1 or 2 stop bits
(13) Communication protocol	X-ON/X-OFF, DTR, RTS control in Block Mode
(14) Cursor control	Dedicated keys for left, right, up, down, home, carriage return, line feed, tab, back tab, backspace
(15) Editing	Line insertion/delete, Line or page edit, character insertion/delete
(16) Cursor attributes	Reverse block blinking/steady, Underline blinking/steady, Not-displayed
(17) Virtual screen memory option	4 screens (Each screen has only one page.)
(18) Non volatile RAM memory	
(19) Printer port	RS232C Interface
(20) Print mode	Page print, screen copy, buffered transparent, bi-directional
(21) Keyboard	Typewriter-styled, detachable, slimline (coiled cable)
(22) Key repeat	Auto repeat (16 characters/sec)
(23) Key roll-over	N-key roll-over
(24) Key pressing force	Return & Enter keys: 35 to 55 gr. Space bar: 35 to 55 gr. All other keys: 35 to 55 gr.
(25) Key stroke	3.8 mm (standard)

(26)	Sound alarm	Piezoelectric buzzer
(27)	Primary power	From 95 to 264 volts A.C. single phase, 47 to 63 Hz
(28)	Cabinet dimensions (W x H x D)	345 x 355 x 355 mm
(29)	Keyboard dimensions (W x H x D)	430 x 40 x 205 mm
(30)	Display Unit weight	10.3 kg
(31)	Keyboard weight	1.36 kg
(32)	Ambient operating temperature	0 to 40°C
(33)	Relative humidity (operating)	20 % to 85 % non-condensing
(34)	Storage temperature	-10 to 60°C

1.2.3 Specifications of Full Graphics Option

(1)	High resolution	640 x 400 dots
(2)	Aspect Ratio	Approximately 4 : 2.5
(3)	High speed drawing	Max. speed 800ns/dot * Drawing speed of 200 dots radius circle is less than 10 ms. * Painting circle of 200 dots radius is less than 3.5 sec. (Used by arbitrary fill command.) * Drawing rectangular 640 X 400 dots is less than 10 ms.
(4)	Grey scale option	7 distinguishable levels
(5)	Mouse interface	RICOH MOUSE RM-3100 with 25p connector or equivalent. Maximum cable length = 3 feet

2. DESCRIPTION OF COMPONENTS

2.1 Front View

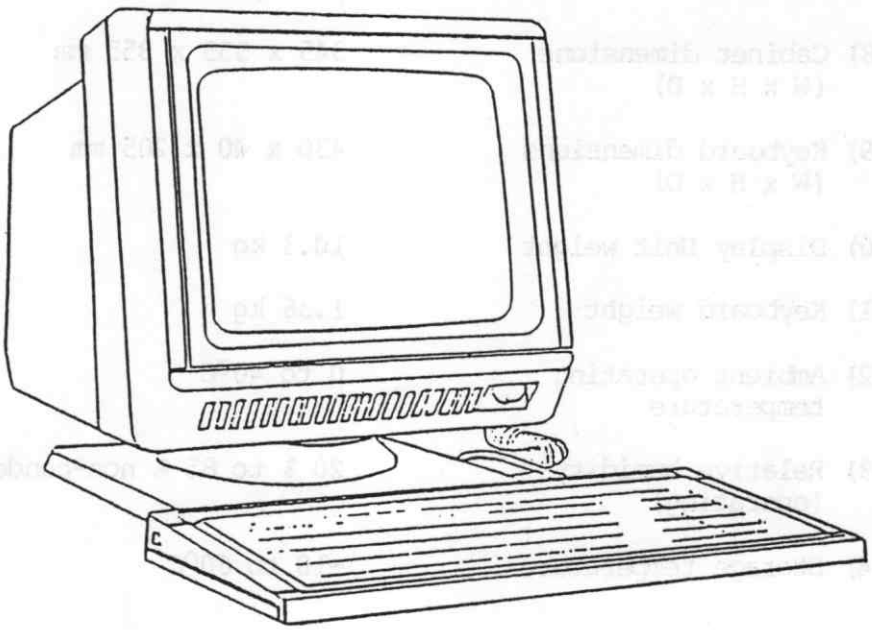


Fig. 2.1 Front View

2.2 Rear View

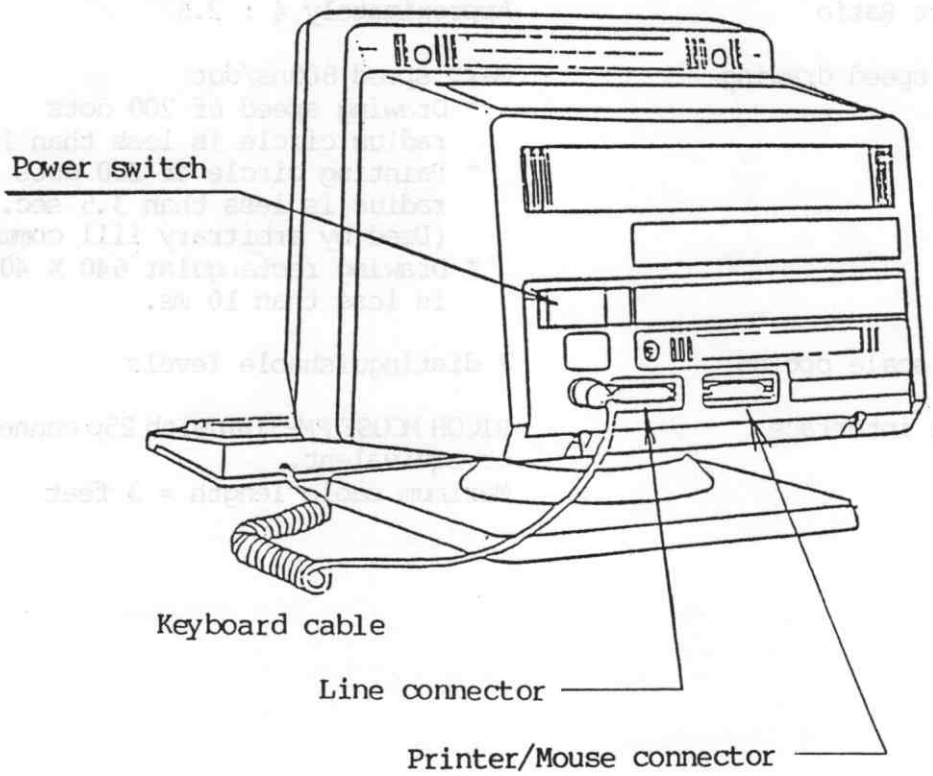
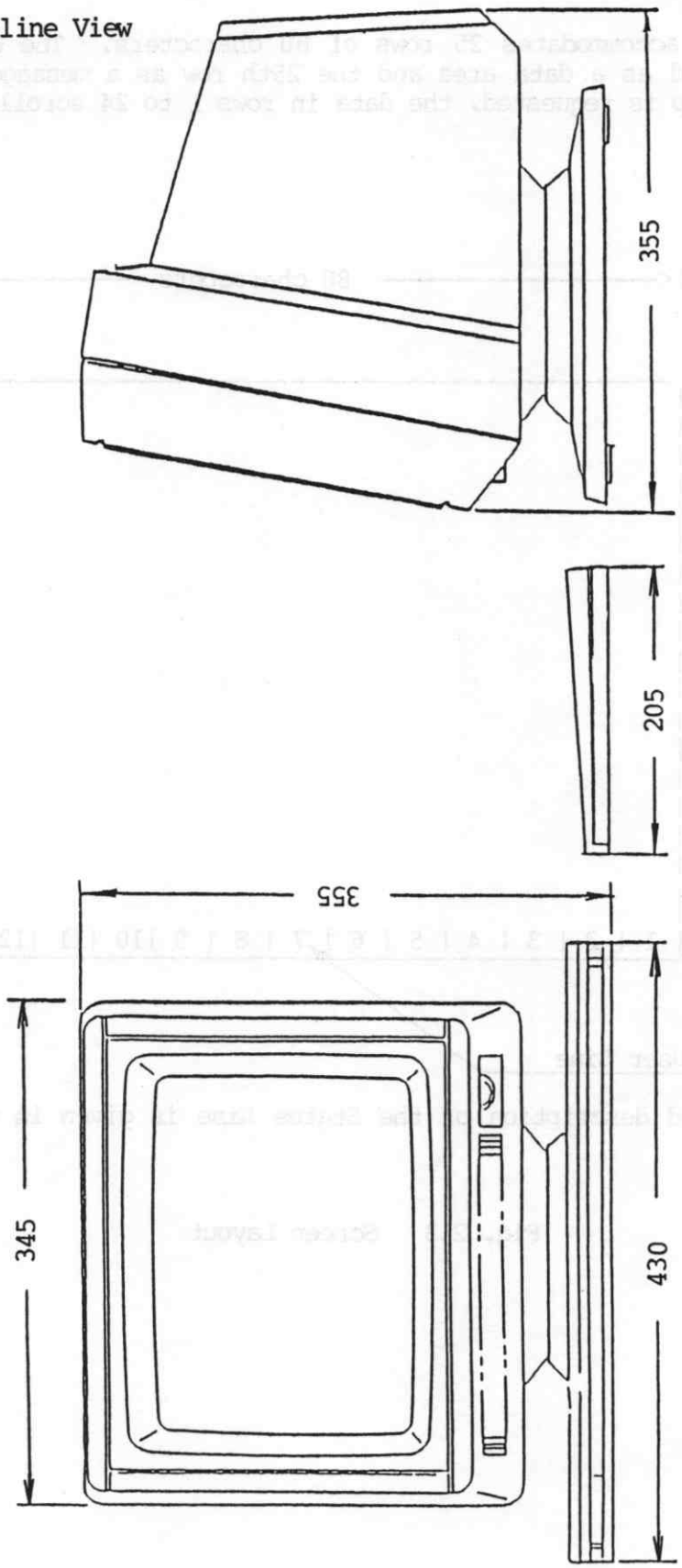


Fig. 2.2 Rear View

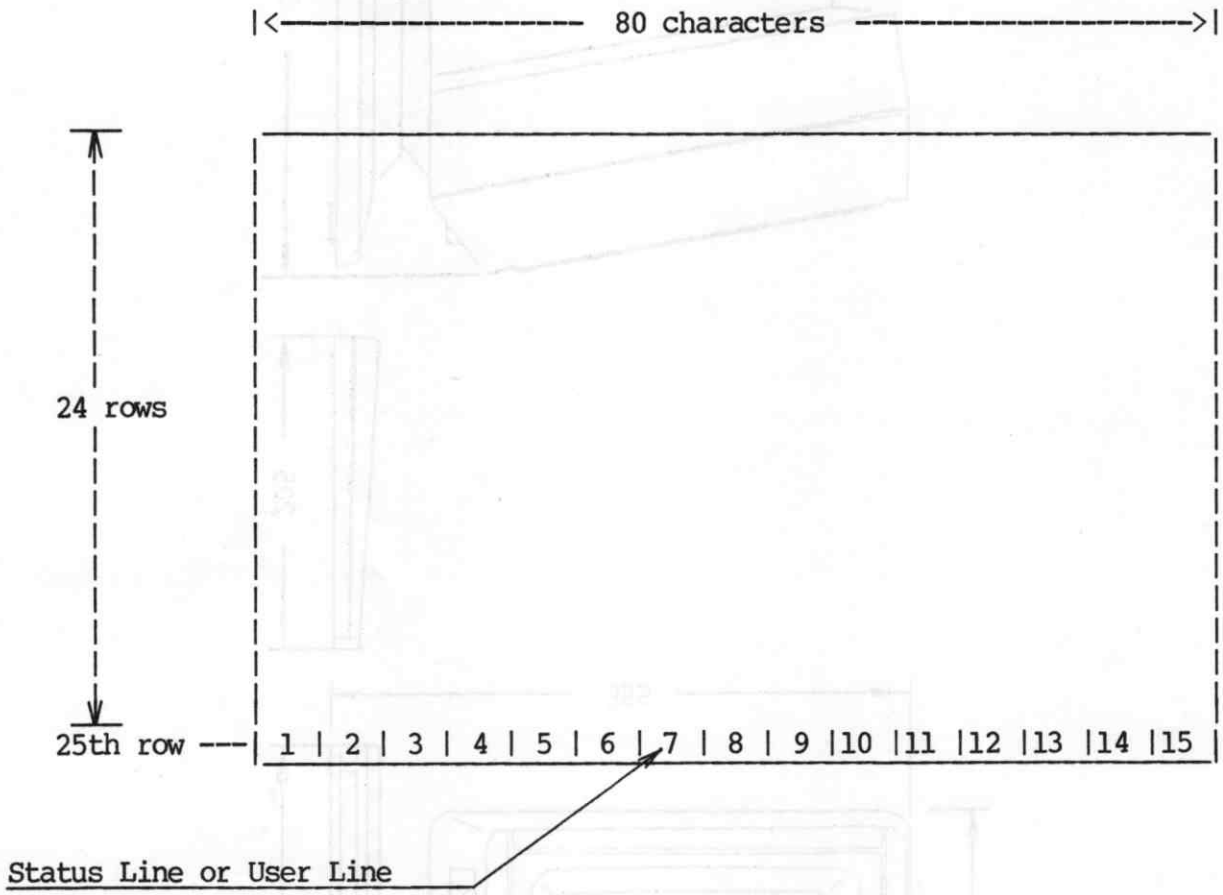
6402G Outline View



All dimensions are in millimeters.

2.3 Screen Layout

The screen accommodates 25 rows of 80 characters. The upper 24 rows are assigned as a data area and the 25th row as a message area. When scrolling up is requested, the data in rows 1 to 24 scrolls up.



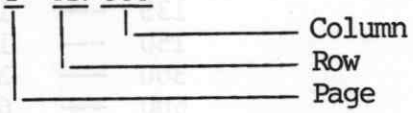
* A detailed description of the Status Line is given in the following section.

Fig. 2.3 Screen Layout

2.3.1 Status Line

(1) Cursor position indicated

Example: P RR CCC



	Page	Row	Column	
Cursor home position	0	01	001	0 01 001
Bottom row, last column	0	24	080	0 24 080

(2) Blank

(3) Printer status display
- PBSY --- Printer busy
- Blank --- Normal condition

(4) Print mode display
- PRT0 --- Page print mode
- PRT1 --- Unformatted print mode
- PRT2 --- Copy print mode
- PRT3 --- Buffer print mode
- BDIR --- Bidirectional mode
- Blank --- Non printing mode (initial)

(5) Blank

(6) WordStar mode display
- W.S. --- WordStar mode
- Blank --- 6402G mode

(7) Attribute mode display
- S.F. --- Serial field attribute mode
- P.C. --- Parallel character attribute mode

(8) Edit mode display
- EDTL --- Edit Line mode (initial)
- EDTP --- Edit Page mode
- INSL --- Insert Line mode
- INSP --- Insert Page mode

(9) Keyboard Lock display
- KLOK --- Locked status
- Blank --- Unlocked status

(10) Protect mode display
- PROT --- Protect mode
- Blank --- Unprotect mode

(11) Graphics/Half intensity mode display
- GRPH --- Graphics data entry mode
- H.I. --- Half intensity data entry
- Blank --- Normal data entry (initial)

(12) Transmission mode display
- HDX --- Half-duplex mode
- FDX --- Full-duplex mode
- BLK --- Block mode
- LOC --- Local mode

(13) Baud rate display (Host)	50	--- 50 baud
	75	--- 75 baud
	110	--- 110 baud
	135	--- 135 baud
	150	--- 150 baud
	300	--- 300 baud
	600	--- 600 baud
	1200	--- 1200 baud
	1800	--- 1800 baud
	2400	--- 2400 baud
	3600	--- 3600 baud
	4800	--- 4800 baud
	7200	--- 7200 baud
	9600	--- 9600 baud
	19.2	--- 19200 baud
(14) Error message display	ER01	--- Program (ROM) error
	ER02	--- Program (RAM) error
	ER03	--- Non-volatile RAM error
	ER04	--- Graphics memory error
	ER30	--- Line error of Main port i.e. OFF state of both Data set ready and Data received line signal detector
(15) Transmission status display	SEND	--- Data are being sent
	Blank	--- Normal

2.3.2 User Line

The status display on the 25th row can be erased by the input of ESC g, while ESC f allows up to 80/132 characters to be input, excluding graphics characters from the keyboard.

2.4 Keyboard Layout

Fig. 2.4 Keyboard (U.K.)

2.5 SET-UP Operation

When you receive your terminal, the terminal operating characteristics are already set to the default values. However, this configuration may not necessarily fit your requirements, and you will probably want to change these operating characteristics.
The set-up operation provides an easy method of changing the operating characteristics of your terminal, so that it can communicate with other systems.

Note the default value for Screen Refresh is set to 60 Hz to prevent flicker on reverse video operation. However should screen wobble occur when operating from 50 Hz supplies then the Screen Refresh should be reset to 50 Hz.

2.5.1 Introduction to Non Volatile RAM (NVRAM)

This terminal has Non Volatile RAM (NVRAM).
NVRAM provides a means of retaining terminal set-up and status information even when the terminal is switched off and saved via the keyboard.

This information can be displayed, altered and saved by keyboard operation.

2.5.2 SET-UP Operation

In the SET-UP mode, the menu selection for setting terminal operation characteristics is available.

The following "flow chart" (page 11) gives an outline of "SET-UP" operation.

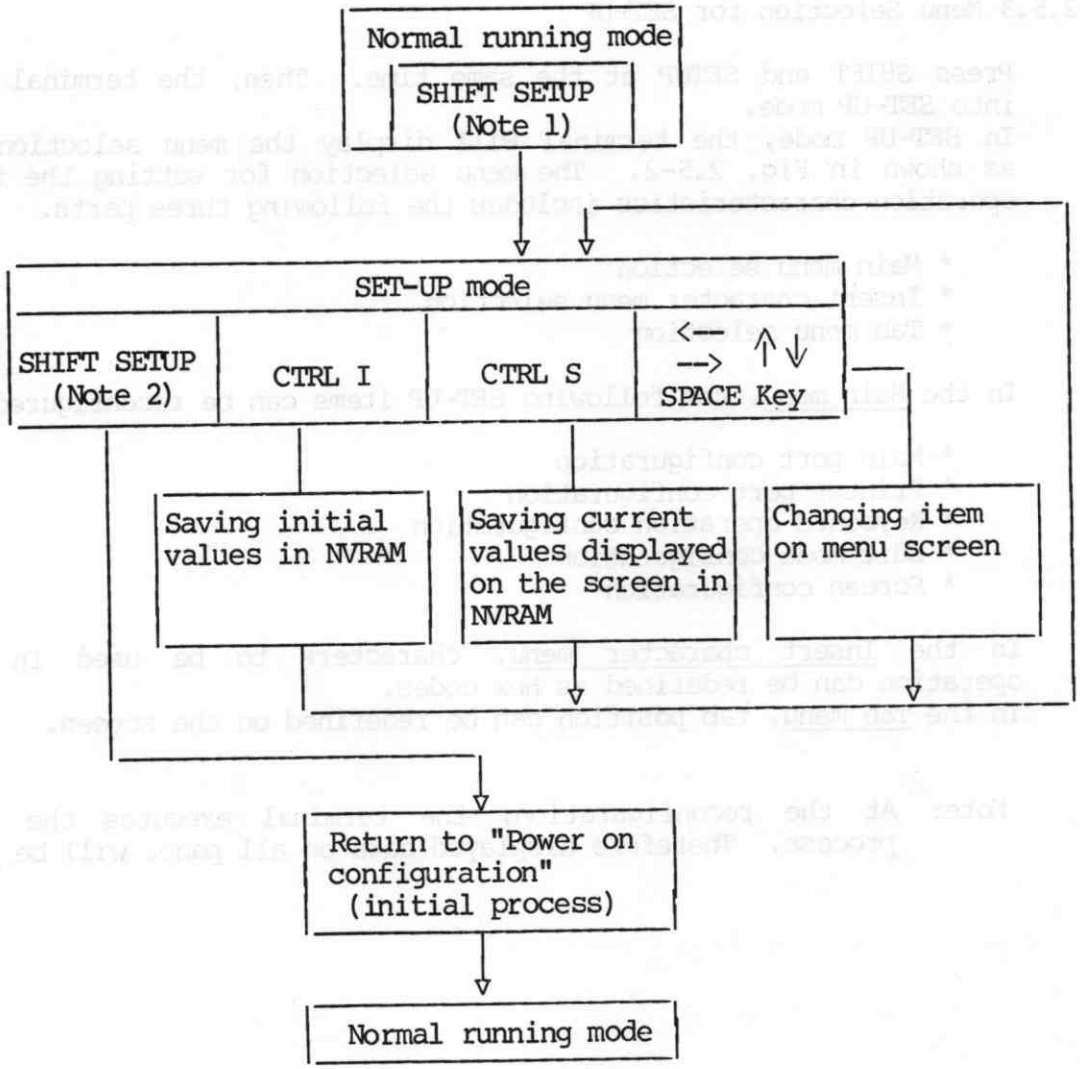


Fig. 2.5-1 Outline of SET-UP Operation

Note: The figure above shows the keys available in each mode and the result of pressing those keys.

Note 1 Press **SHIFT** and **SETUP** at the same time.
Note 2 Press **SHIFT** and **SETUP** at the same time to leave the SET-UP mode and return to normal running mode.

2.5.3 Menu Selection for SET-UP

Press SHIFT and SETUP at the same time. Then, the terminal enteres into SET-UP mode.
In SET-UP mode, the terminal will display the menu selection format as shown in Fig. 2.5-2. The menu selection for setting the terminal operation characteristics includes the following three parts.

* Main menu selection
* Insert character menu selection
* Tab menu selection

In the Main menu, the following SET-UP items can be reconfigured.

* Main port configuration
* Printer port configuration
* Keyboard operation configuration
* Edit mode configuration
* Screen configuration

In the Insert character menu, characters to be used in insert operation can be redefined as Hex codes.
In the Tab menu, tab position can be redefined on the screen.

Note: At the reconfiguration, the terminal executes the initial process. Therefore displayed data on all pages will be erased.

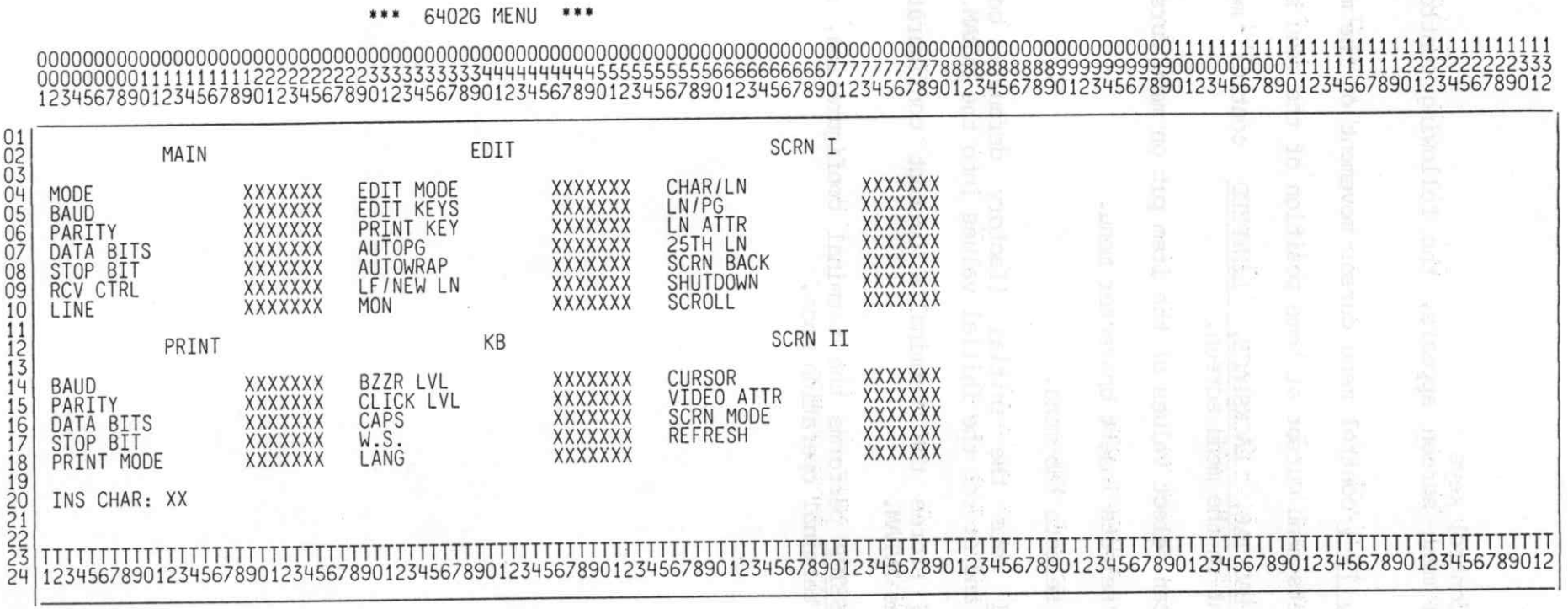


Fig. 2.5-2 Menu Selection Format

2.5.4 Main Menu

(1) Effective control keys
While main menu screen appears, the following control keys can be used.

a. ->, <-, ↑, ↓ control menu cursor movement on the menu screen.

b. HOME sets menu cursor at home position of the menu screen.

c. TAB, BACKTAB, BACKSPACE, LINEFEED control menu cursor movement on the menu screen.

d. SPACE can select values of the item put on menu cursor.

e. CTRL C selects insert character menu.

f. CTRL T selects tab menu.

g. CTRL I sets the initial (factory default) configuration values and stores the initial values into the NVRAM.

h. CTRL S stores the terminal's current configuration values into the NVRAM.

i. SHIFT SETUP performs the terminal configuration, and returns to the terminal operation mode.

(2) Main port configuration

Field Name	Selecting values	Description	Default value
MODE		Transmission mode	FDX
	HDX	Half-duplex mode	
	FDX ✓	Full-duplex mode	
	BLK	Block mode	
	LOC	Local mode	
BAUD			9600
	50	50 baud	
	75	75 baud	
	110	110 baud	
	135	135 baud	
	150	150 baud	
	300	300 baud	
	600	600 baud	
	1200	1200 baud	
	1800	1800 baud	
	2400	2400 baud	
	3600	3600 baud	
	4800	4800 baud	
	7200	7200 baud	
	9600 ✓	9600 baud	
	19.2	19200 baud	
PARITY			EV
	NO	None (No parity)	
	OD	Odd parity	
	EV ✓	Even parity	
	MK	Mark parity	
	SP	Space parity	
DATA BITS		Data bit length	7
	7 ✓	7 bits/char.	
	8	8 bits/char.	
STOP BIT		Stop bit length	1
	1 ✓	1 bit	
	2	2 bits	
RCV CTRL		Receiving data control	DTR
	XON/OFF	X-ON/X-OFF control	
	DTR ✓	DTR control	
LINE		Line interface	RS232
	RS232 ✓	RS232C	
	CRRNT	Current loop	

(3) Edit mode configuration

Field Name	Selecting values	Description	Default value
EDIT MODE			EDTL
	EDTL ✓	Edit Line mode	
	EDTP	Edit Page mode	
	INSL	Insert Line mode	
	INSP	Insert Page mode	
EDIT KEYS		Transmission mode of Edit keys	DUPE
	DUPE ✓	Duplex Edit mode	
	LOCE	Local Edit mode	
PRINT KEY		Transmission mode of Print key	DUPE
	DUPE ✓	Duplex Edit mode	
	LOCE	Local Edit mode	
AUTOPG		Auto Page	OFF
	ON	Auto Page mode ON	
	OFF ✓	Auto Page mode OFF	
AUTOWRAP		Auto wraparound mode	ON
	ON ✓	Autowrap mode ON	
	OFF	Autowrap mode OFF	
LF/NEW LN		Operation mode of LF code	LF
	LF ✓	LF operation	
	NEW LN	New line operation	
MON		Monitor mode	OFF
	ON	Monitor mode ON	
	OFF ✓	Monitor mode OFF	

(4) Screen configuration

CHAR/LN		Char/line	80
	80 ✓	80 char/line	
	132	132 char/line	
LN/PG		Line/page	24
	24 ✓	24 line/page	
	48	48 line/page	
	72	72 line/page	
	96	96 line/page	

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Field Name	Selecting values	Description	Default value
LN ATTR		Default line attribute	NORM
	NORM ✓	Single width single height	
	2HT	Single width double height	
	2WD	Double width single height	
	2WDHT	Double width double height	
25TH LN		25th line display mode	STAT
	NO	None (Blank)	
	STAT	Status Line	
	USER ✓	User Line	
SCRN BACK		Screen background	DARK
	DARK ✓	Dark background	
	LIGHT	Light background	
SHUTDOWN		Auto shut-down	ON
	ON ✓	Auto shut-down ON	
	OFF	Auto shut-down OFF	
SCROLL		Scroll mode	JMP
	JMP ✓	Jump scroll	
	SMTH	Smooth scroll	
CURSOR		Cursor attribute	UL/BLN
	NO	None (Invisible)	
	BLK/BLN	Block blink	
	BLK/STD ✓	Block steady	
	UL/BLN	Underline blink	
	UL/STD	Underline steady	
VIDEO ATTR		Video attribute	P.C.
	S.F.	Serial field attribute	
	P.C. ✓	Parallel character attribute	
SCRN MODE		Screen control mode	PG
	PG	Page screen mode	
	VS ✓	Virtual screen mode	
REFRESH		Refresh rate	60
	50	50 Hz	
	60 ✓	60 Hz	

(5) Printer port configuration

Field Name	Selecting values	Description	Default value
BAUD			9600
	50	50 baud	
	75	75 baud	
	110	110 baud	
	135	135 baud	
	150	150 baud	
	300	300 baud	
	600	600 baud	
	1200 ✓	1200 baud	
	1800	1800 baud	
	2400	2400 baud	
	3600	3600 baud	
	4800	4800 baud	
	7200	7200 baud	
	9600	9600 baud	
	19.2	19200 baud	
PARITY			EV
	NO	None (No parity)	
	OD	Odd parity	
	EV ✓	Even parity	
	MK	Mark parity	
	SP	Space parity	
DATA BITS		Data bit length	7
	7 ✓	7 bits/char.	
	8	8 bits/char.	
STOP BIT		Stop bit length	1
	1 ✓	1 bit	
	2	2 bits	
PRINT MODE			NO
	NO ✓	None	
	PRT2	Copy print mode	
	PRT3	Buffer print mode	
	BDIR	Bidirectional mode	

(6) Keyboard operation configuration

Field Name	Selecting values	Description	Default value
BZZR LVL		Buzzer level	MED
	NO	None	
	LOW	Low	
	MED	Medium	
	LOUD ✓	Loud	
CLICK LVL		Click level	MED
	NO	None	
	LOW	Low	
	MED	Medium	
	LOUD ✓	Loud	
CAPS		Capslock default value when the configuration	OFF
	ON	Capslock ON	
	OFF ✓	Capslock OFF	
W.S.		W.S. mode	OFF
	ON	W.S mode	
	OFF ✓	6402G mode	
LANG		Language variant	U.K.
	U.K. ✓	U.K.	
	U.S.	U.S.A.	
	GERM	German	
	FREN	French	
	SWE/FIN	Swedish/Finnish	
	DAN/NOR	Danish/Norwegian	
	DUTCH	Dutch	
	ITAL	Italian	
	SPAN	Spanish	
	PORT	Portuguese	
	C.FREN	Canadian French	

2.5.5 Insert Character Definition

Depress CTRL C when main menu screen is displayed. The cursor will be set at INS CHAR item.

```
INS CHAR:  20
           ↑—— cursor
```

Insert character can be redefined by a pair of hex codes. If the most significant bit of the redefined character code is "1", it will be treated as a half-intensity character.
CTRL C is depressed again, then the terminal returns to the main menu selection mode.
In this mode, the following keys are effective.

a. Hex code key: '0' to '9', 'A' to 'F' define insert character code.

b. ->, <-, BACKSPACE control cursor movement on the 20th line.

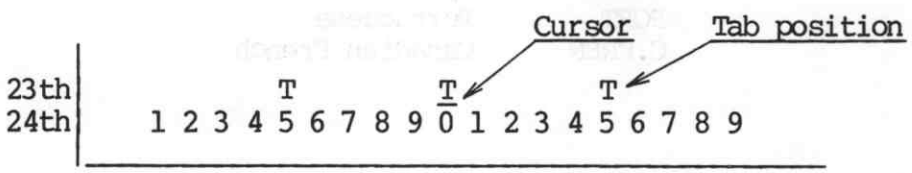
c. CTRL C returns to main menu.

d. SHIFT SETUP performs the terminal configuration, and returns to the terminal operation mode.

2.5.6 Tab Setting

Depress CTRL T when main menu screen is displayed, and the cursor will be set on the first column of the 23th line.
In the Tab Setting mode, the tab position can be defined freely at any column. Cursor movement can be done by pressing cursor control keys: -> or <-. Space key can be altered the definition of the cursor position a tab and non-tab position.
TAB setting positions are indicated by "T".
Initially, no TABs are set.

Example:



In the above example, TAB positions are set on columns 5, 10 and 15.
In this mode, the following control keys are effective.

a. ->, <-, BACKSPACE control cursor movement on the 23th line.

b. TAB, BACKTAB control TAB/BACKTAB operation.

c. SHIFT TAB clears all tab definition. 23th line turns to a blank line.

d. SPACE sets or clears a tab stop.

e. SHIFT ->, SHIFT <- control window movement.
(132 char/line only)

f. CTRL T returns to main menu selection.

g. SHIFT SETUP performs the terminal configuration, and returns to the terminal operation mode.

2.5.7 Changing NVRAM Information

Changing the system status configurations.

(1) Call up the Main menu display mode.

(2) Press ->, <- keys to move the cursor to the item position you wish to change, then press the space key to change the content to the value you require.

(3) Perform a save operation, ... Press CTRL S.

2.5.8 Saving NVRAM information

At this stage you can either decide to make the changes to the configuration permanent or you can decide to return to the original configuration. To select either option you must first call up the Set-up menu screen then:

Press CTRL S To save current configuration as displayed on the screen.

Press CTRL I To retain original configuration.

2.5.9 Remote "SET-UP"

When the Remote Set-up sequence (ESC m refer to section 3.30 page 66) is received, the terminal stores the configuration values, of the current communication page into NVRAM.

3. FUNCTIONS AND ACTION

In an explanation of an escape sequence or control sequence in this section, you need not to enter a space between "ESC" or "CTRL" and a character or between each character; the space is for clarity only. The local escape sequences described in the following sections may be produced from the keyboard by pressing LOC ESC (**SHIFT** and **ESC**).

3.1 Operating Modes

The 6402G Character Display Terminal consists of a video display processor that receives input from a host computer and a keyboard for presentation on a CRT screen. Data is input to the processor in serial through RS232C standard ports. The keyboard although laid out like a standard typewriter, contains additional keys for communicating with a computer. Unlike a typewriter (where pressing a key results directly in a typed character), the 6402G keyboard **transmits** a code (American Standard Code of Information Interchange --- ASCII) to the display processor for action. Depending on the terminal's communication mode, the processor either sends the typed character directly to the screen or transmits it to the host for action. The 6402G may be set to one of four transmission modes.

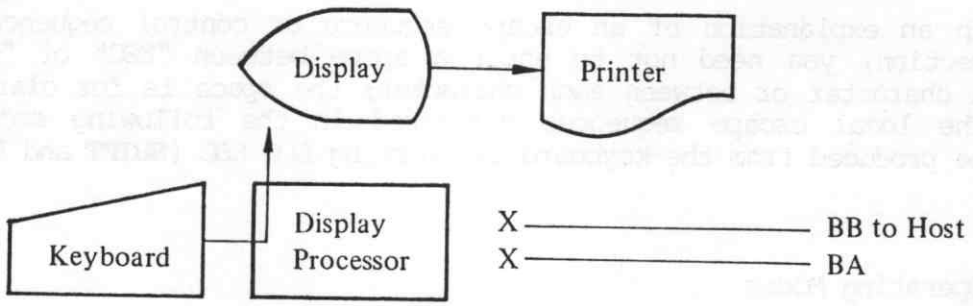
(1) Local mode
In the Local mode (see Figure 3.1 page 24), the display processor sends keyboard entries directly to the screen for presentation (characters) or for control. When the display terminal is in this mode, "LOC" appears in the 25th row on the screen.

(2) Block mode
The Block mode sends keyboard entries to the screen, and when the operator chooses, it sends the entries as a block of text to the host computer. When the display terminal is in this mode, "BLK" appears in the 25th row on the screen.

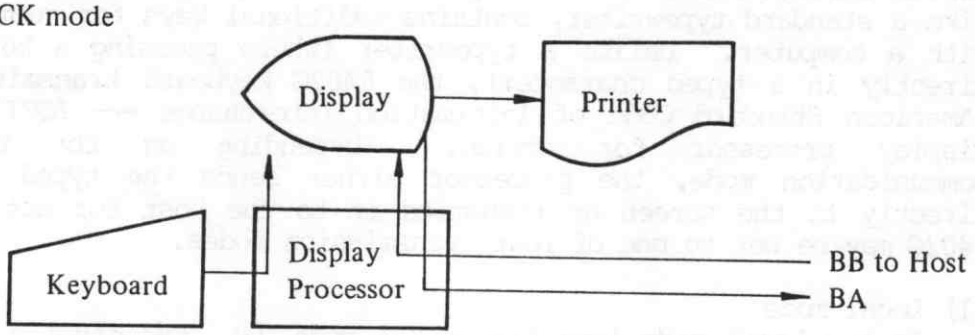
(3) Half-duplex mode
The Half-duplex mode sends keyboard entries to the screen and to the host at the same time. When the display terminal is in this mode, "HDX" appears in the 25th row on the screen.

(4) Full-duplex mode
The Full-duplex mode sends keyboard entries to the host only; if the host is programmed to act upon a code received from a keyboard entry, it may send the result back to the terminal. For example if the **A** is pressed on the keyboard, the host will probably send the character **A** back to the terminal's display processor for writing on the screen. When the display terminal is in this mode, "FDX" appears in the 25th row on the screen.

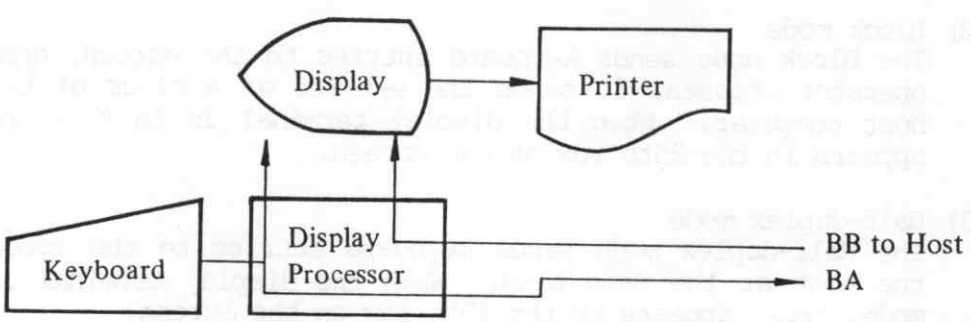
LOCAL mode



BLOCK mode



HDX mode



FDX mode

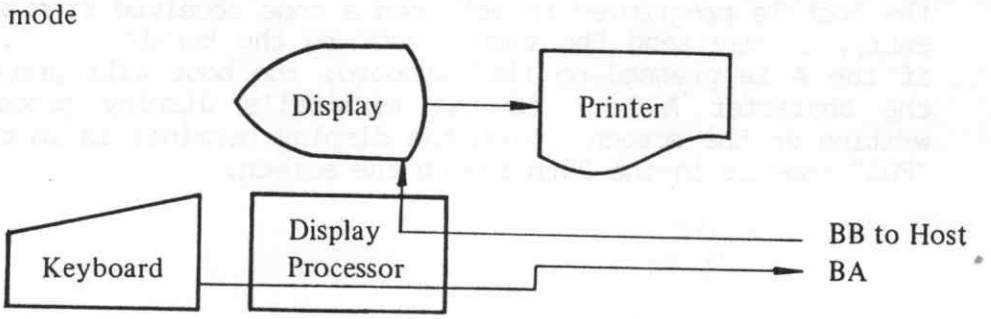


Fig. 3.1 Operating modes

3.2 Key Functions

The keyboard consists of six functional areas; the alphanumeric keys, the editing and cursor control keys, the function keys, the SETUP key, Local Escape and shift Break, the **BREAK** key, and the key modifiers.

3.2.1 Alphanumeric Keys

The alphanumeric key group (see Figure 2.4 page 9) contains all the "typewriter" letter, number, and symbol keys on the keyboard. This group also contains the carriage **RETURN**, **LINEFEED**, **ENTER**, **LOC ESC/ESC**, and **DEL** keys.

The **RETURN** and **ENTER** keys perform the same function. They send the **ASCII** code for a carriage return (CR) to the display processor. Depending on the terminal's communication mode, the code causes the processor to trasmit a CR to the host and the cursor to be moved to column 1 of the current line.

The 6402G features a wraparound function, which eliminates the need to manually enter a carriage return and a linefeed at the end of each 80-character line or 132-character line.

The **LINEFEED** key sends an **ASCII** code for a linefeed (LF) to the display processor. Depending on the terminal's communication mode, the code causes the processor to transmit an LF code to the host and/or the cursor to be moved down one line on the screen.

The **ESC** key sends an **ASCII** code for Escape to the display processor. The key is generally used to momentarily leave (escape) an application program in order to use a special feature or function.

When pressed, **ESC** causes the next control character entered to be displayed on the screen. For example, pressing **ESC CTRL A** causes S_H to be displayed.

When pressed in combination with **SHIFT**, the key operates only locally to invoke the terminal's functions and special features. It causes the next character entered to be interpreted as a command. For example, pressing **SHIFT LOC ESC** < turns keyclick off and pressing **SHIFT LOC ESC** > turns keyclick on.

The **DEL** key sends an **ASCII DEL** character to the display processor, and depending on the terminal's communication mode, the processor retransmits an **ASCII DEL** code to the host.

3.2.2 Editing and Cursor Control Keys

The cursor control keys (↑ , ↓ , <-, ->, **BACKSPACE**, and **HOME**) normally control cursor movement on the screen. The editing keys (see Figure 2.4 page 9) control insert and delete characters and lines and clear function. The **PRINT** and **SEND** keys control data transmission from the screen to the printer or host computer.

The keys operate in the same mode as the alphanumeric keys by transmitting their associated control code or escape sequence and/or perform their action locally. The editing and cursor control keys are:

(1) **TAB** and **BACKTAB**
(2) **CHAR INSERT** and **CHAR DELETE**
(3) **LINE INSERT** and **LINE DELETE**
(4) **LINE ERASE** and **PAGE ERASE**
(5) **BACKSPACE, HOME,** ↑ , ↓ , <-, and ->
(6) **CLEAR SPACE**
(7) **SEND** and **PRINT**

a. Tab Control Keys
TAB (ESC i) and **BACKTAB** (ESC I) move the cursor forward or backward to typewriter tabs (Protect mode off) or to the next start or previous start of an unprotected field (Protect mode on). (refer to section 3.8.4 page 41)

b. Character Insert Key
CHAR INSERT (ESC Q) enters the insert character at the cursor position, causing all succeeding characters to shift one position to the right. If the terminal is set to the Edit Line mode (EDTL refer to section 3.5.4(4) page 38), characters shifted off screen to the right are lost. If the terminal is set to the Edit Page mode (EDTP refer to section 3.5.4(4) page 38), characters shifted beyond column 80 or 132, are moved to the first column of the next line. (refer to section 3.5.4(4) page 38)
When **CHAR INSERT** is pressed at the same time as **SHIFT**, the Insert mode is turned on (ESC q).

c. Character Delete Key
CHAR DELETE (ESC W) deletes the character at the cursor position and causes all succeeding characters to shift one position to the left. If the terminal is set to the Edit Line mode (EDTL), the character position at the end of the line is replaced with the insert character. If the terminal is set to the Edit Page mode (EDTP), characters from the first column of the next line are shifted into the last positions on the current line. (refer to section 3.5.4(4) page 39)
When **CHAR DELETE** is pressed at the same time as **SHIFT**, the Insert mode is turned off (ESC r).

d. Line Insert and Delete Keys
The **LINE INSERT** (ESC E) key creates an entire line of insert characters on the cursor line. The data on the cursor line and all following lines shift down one line (the last line of the page is lost). **LINE DELETE** (ESC R) causes the entire line at the cursor position to be deleted. All the following lines shift up one line. When **LINE INSERT** or **DEL** is pressed at the same time as **SHIFT**, Edit page is turned on (ESC N) or off (ESC O), respectively.
(refer to section 3.5.4(4) page 38)

e. Line Erase and Page Erase Keys

LINE ERASE (ESC T) and **PAGE ERASE** (ESC Y) replace the unprotected data (from the cursor to the end of the line or page) with the insert character of the proper intensity. When the keys are pressed at the same time as **SHIFT**, they cause a line to be erased to nulls (ESC t) or a page to be erased to nulls (ESC y).

f. Cursor Control Keys

When set to Local mode, the **BACKSPACE**, ↑ , ↓ , <-, and -> keys move the cursor in the directions indicated on the key cap. **HOME** moves the cursor to the first unprotected position on the current page. (refer to section 3.5.4(1) page 36)

g. Clear Space Key

CLEAR SPACE (CTRL Z) replaces all unprotected characters on a page with insert characters. when pressed at the same time as **SHIFT** (ESC *), it clears the entire page to nulls and turns off the Protect, Graphic and Half intensity modes. (refer to section 3.7 page 40)

h. Print Key

PRINT causes all data on a page from the home position to the cursor position (not just the screen) to be output through the terminal printer port. The data is output with a CR, LF, and null automatically inserted at the end of each 80-column line or 132-column line (**PRT 0**) or, when **PRINT** is pressed at the same time as **SHIFT**, without the CR and LF or null (PRT 1).

When the terminal is outputting data through the printer port, **PRT 0**, **PRT 1**, **PRT 2**, **PRT 3**, or **BDIR** (bidirectional) appears on the Status Line.

PRT 2 indicates the Trasparent Print mode, in which data output from the host is sent to the printer port and to the screen.

PRT 3 indicates that data output from the host is sent directly to the printer, bypassing the screen.

BDIR turns on two-way communication through the printer port to allow conversation between a printer with a keyboard (a **KSR** device) and the host.

PRT 2, **PRT 3** and **BDIR** are print modes generally turns on by the host, although they may be turned on at the keyboard. (refer to section 3.14 page 50)

i. Send Key

The **SEND** key may be programmed to transmit line or page data. The key operates both unshifted and shifted for transmission of two character Escape sequences. Transmission of text data by the **SEND** key may include the use of embedded delimiters that define field, ends of lines, and the end of text. Data may be sent to a host from the 6402G by several methods in order to conform to the editing mode of the terminal. These methods are line and page. In addition either all data or only unprotected data can be selected for transmission. (refer to section 3.13 page 47)

3.2.3 Function Keys

The function keys (see Figure 2.4 page 9), **F1** to **F11**, are user defined. When pressed, the keys cause the processor to send a user-defined code to the screen, to the host, or to both, depending on whether the key was set up for Local or Duplex mode. For example, the user-defined code may consist of a frequently used Escape or Control code sequence in a text editing application. Up to 22 codes may be defined-two per key. Pressing **SHIFT** at the same time as a function key transmits the second code on the key.

The FUNCT key transmits a user-selected character bracketed by Control A (SOH) and a Carriage Return (CR). For example, if a Control A C CR sequence is required for a special operation in a text editing program, pressing FUNCT and C at the same time transmits CONTROL A C CR to the host automatically. (refer to section 3.21 page 45)

3.2.4 **NOSCL** Key

When the **NOSCL** key is pressed once, the terminal stops updating the screen and the received data is buffered. When pressed again the terminal starts updating the screen with the buffered data.

If the receive buffer fills up while updating is disabled, X-OFF will be sent to the host, causing it to stop sending data. When updating is re-enabled, the buffer will empty, causing X-ON to be sent and data to be transmitted by the host.

3.2.5 **SETUP** Key

The **SETUP** key (see Figure 2.4 page 9) provides SET-UP mode to adjust the terminal condition. The operation is described in section 2.5 page 10.

3.2.6 **BREAK** Key

The **BREAK** key (see Figure 2.4 page 9) causes the 6402G to transmit a break pulse of about 250 ms to the host. The effect of this signal depends on the operating program and sounds the bell tone.

When pressed at the same time as **SHIFT**, **BREAK** performs a limited terminal reset by clearing the function in progress. It turns off the Print mode if on, turns off Protect, Graphic and Half intensity modes, and sounds the bell tone to indicate the reset.
When pressed at the same time as **CTRL**, **BREAK** executes power-on sequence.

3.2.7 Key Action Modifiers

The control keys of the 6402G (see Figure 2.4 page 9) are conventional and include control (**CTRL**), **SHIFT**, and **CAPS LOCK**. These keys by themselves have no effect on the terminal or host; however, when they are used in combination with other keys, they change (or modify) the code sent to the terminal processor for the key pressed.

(1) Control Key
The **CTRL** key modifies the code sent by another key. When pressed at the same time as another key, the keyboard sends a unique code. The control key combinations are used for special function of the 6402G and/or the application program of the host. For example, a **CTRL G** key combination sounds the 6402G bell. The 6402G control codes either duplicate existing dedicated keys on the keyboard or control functions normally controlled by the host, such as sounding the bell.

(2) **SHIFT** Key
The **SHIFT** key functions in a similar way to the **CTRL** key by modifying the code sent by another key pressed at the same time. The most familiar use of this key is to produce upper case characters on the screen. However, it is also used in combination with the dedicated keys of the terminal for special functions.

(3) **CAPS LOCK** Key
The **CAPS LOCK** key locks the **SHIFT** keys so that all alpha keys transmit codes for upper-case characters. The key is pressed to lock and pressed again to release.

Please Note

If the keyboard is disconnected when the power is on, then the keyboard repeat function will be disabled. To restore the repeat function the terminal must be powered off and then on again.

3.3 Video Attribute Modes

3.3.1 Dual Functionality for the Video Attribute

The 6402G has dual functionality for the Video attribute; Serial Field/Parallel Character.
The Escape sequence "ESC V" determines this Attribute mode.

ESC V n where n = 1 Parallel character attribute mode on
                   0 Serial field attribute mode on
                      (6402 mode on)

This dual functionality for the Video attribute will achieve 6402 compatibility on the attribute function. This attribute mode could be set by the "Set-up Procedure" (refer to section 2.5.4 page 14) and could be stored into NVRAM, by using "Remote Set-up Capability" (refer to section 3.30 page 66).
When receiving this Escape sequence, the terminal clears the display and changes the attribute mode.

3.3.2 Attribute Sets on the Attribute Functions

The 6402G has two attribute sets on the attribute functions in order to achieve 6402 compatibility.

(1) ESC G p (Serial field attribute)

where p = 0 for normal
          1 for blank
          2 for blink
          3 for blink blank
          4 for reverse
          5 for reverse blank
          6 for reverse blink
          7 for reverse blink blank
          8 for underline
          9 for blank underline
          : for blink underline
          ; for blink blank underline
          < for reverse underline
          = for reverse blank underline
          > for reverse blink underline
          ? for reverse blink blank underline

This Escape sequence is equivalent to the 6402 attributes and will cause a protected space to be left on screen so as to emulate serial attribute mode of operation.

Note: When the terminal is the Parallel character attribute mode, this Escape sequence is not effective.

(2) ESC [p_1 p_2 p_3 (Parallel character attribute)

where p_1 is the Video attribute

= 0	for normal
1	for blank
2	for blink
3	for blink blank
4	for reverse
5	for reverse blank
6	for reverse blink
7	for reverse blink blank
8	for underline
9	for blank underline
:	for blink underline
;	for blink blank underline
<	for reverse underline
=	for reverse blank underline
>	for reverse blink underline
?	for reverse blink blank underline

p_2, p_3 is ignored.

Note: When the terminal is the Serial field attribute mode, this Escape sequence is not effective.

To achieve compatibility with 6404 and 6404CG Colour Terminals, p_2 and p_3 have been included in the Escape sequence even though they are ignored.

Note: When writing programs that intend to run on both 6404 and 6402G, then the following information must be taken into account.

p_2, p_3 is the Foreground/Background colour of 6404 and 6404CG

where = 0	for Black
1	for Red
2	for Green
3	for Yellow
4	for Blue
5	for Magenta
6	for Cyan
7	for White.

3.4 Virtual Screen Control

The 6402G has two screen control modes; Page screen mode and Virtual screen mode.
These two modes can be selected by the following escape sequence.

Select screen mode:

ESC V 4 m	where m =	0	Page screen mode
		1	Virtual screen mode

When powered on, the terminal enters into Page screen mode unless the NVRAM has been set to Virtual screen mode.

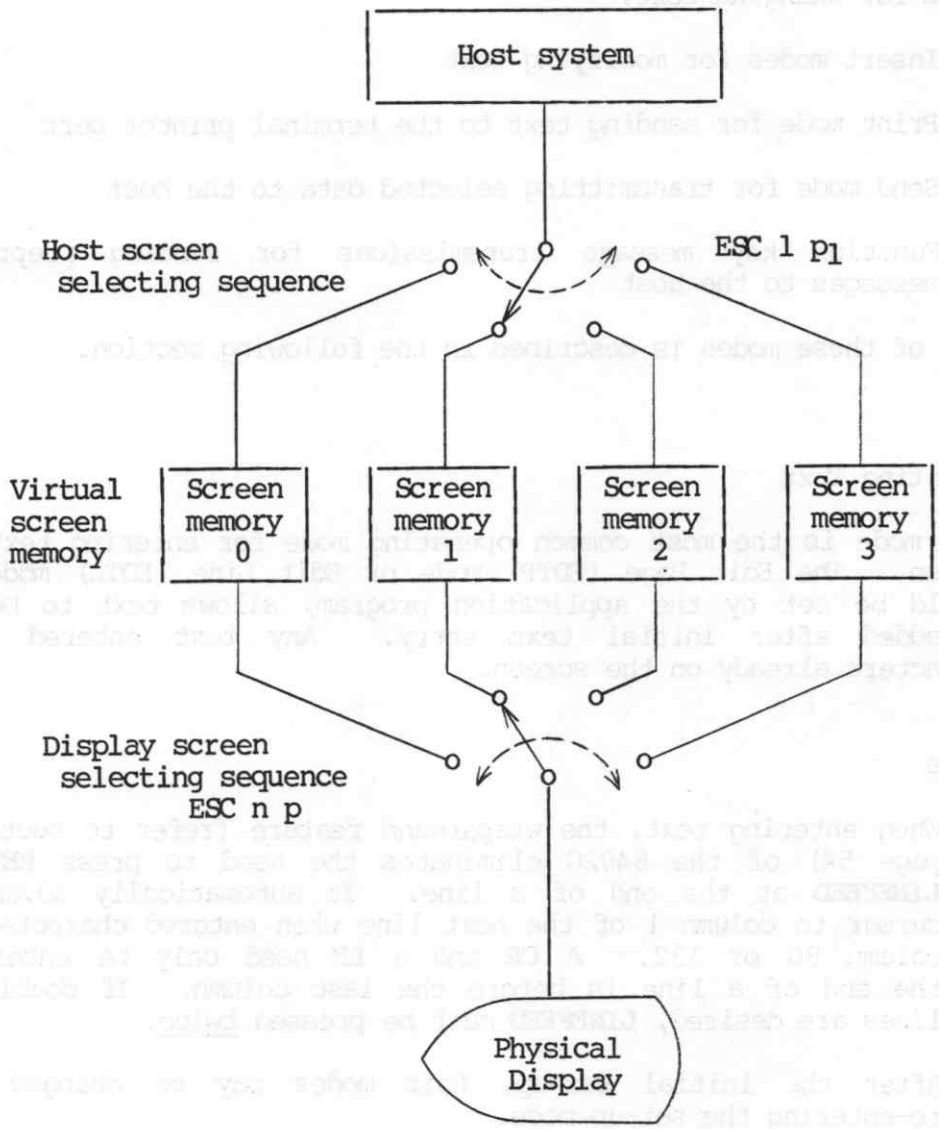
Virtual screens are channels that you can switch back and forth between as you would switch channels on a television.
6402G has four virtual screens.
With host system, you can write data on one virtual screen, while another virtual screen is displayed. The terminal can be switched from one virtual screen to another by receiving the ESC sequence.
To control the virtual screen, the 6402G has two extra escape sequences, one to direct host output to a specified virtual screen and one to display a specified virtual screen.

Select host screen:

ESC 1 p	where p =	0	select screen 0
		1	select screen 1
		2	select sereen 2
		3	select screen 3

Select display screen:

ESC n p	where p =	0	select screen 0
		1	select screen 1
		2	select screen 2
		3	select screen 3


Host system
Host screen selecting sequence
ESC 1 p1
Virtual screen memory
Screen memory 0
Screen memory 1
Screen memory 2
Screen memory 3
Display screen selecting sequence ESC n p
Physical Display

3.5 Text/Data Control Modes

For basic character display operation, the 6402G provides several methods for controlling text or data entry. These methods are Edit modes for changing text.

* Insert modes for modifying text
* Print mode for sending text to the terminal printer port
* Send mode for transmitting selected data to the host
* Function key message transmissions for sending preprogrammed messages to the host

Each of these modes is described in the following section.

3.5.1 Editing Text

Edit mode is the most common operating mode for entering text on the screen. The Edit Page (EDTP) mode or Edit Line (EDTL) mode, which should be set by the application program, allows text to be edited or added after initial text entry. Any text entered replaces characters already on the screen.

Note

When entering text, the wraparound feature (refer to section 3.19 page 54) of the 6402G eliminates the need to press **RETURN** and **LINEFEED** at the end of a line. It automatically advances the cursor to column 1 of the next line when entered characters reach column 80 or 132. A **CR** and a **LF** need only be entered when the end of a line is before the last column. If double-spaced lines are desired, **LINEFEED** must be pressed twice.

After the initial set-up, Edit modes may be changed without re-entering the set-up mode.
To enter an Edit mode, type its code in the exact sequence shown below:

EDIT MODE	CODE
Local Edit	ESC k 1
Duplex Edit	ESC k 0
Set Page Edit	ESC N
Clear Page Edit	ESC O

These modes operate in addition to the dedicated editing keys (refer to section 3.2.2 page 25).

3.5.2 Inserting Text

The insert mode allows text to be inserted on a line basis or a page basis into text previously entered. Additions are done by setting the cursor at the insertion point and typing in the text. Existing text shifts to the right as the new text is entered. Insert mode is entered or cleared either by going to the SETUP mode (refer to section 2.5 page 10) or by typing one of the following control sequences.

		Code
Set	insert mode	ESC q
Reset	insert mode (set edit mode)	ESC r

When the terminal is operated in the Insert Line mode and Edit Line mode, any character typed causes the cursor and all data to the right of the cursor (within the line or field) to move one column to the right. The character typed is displayed in the cursor position before the insert; the last character in the line or field will be lost. When the terminal is operated in the Insert Page and Edit Page the last character in each line following the cursor is shifted to the first position of the next line. This shifting process continues until the end of the page is reached and the last character is lost. Nulls and spaces are characters for editing purposes.
(refer to section 3.5.4(4) page 38)

3.5.3 Protect Mode

The 6402G features a Protect mode in which defined screen/page areas may be set to prevent data entries by the system operator. This feature is particularly useful for setting up forms on the screen for purchasing or accounting or similar applications. When the terminal is in the Protect mode, only unprotected fields may be accessed for data entry or change. The mode operates in conjunction with half intensity; when the Protect mode is enabled, all half intensity, attribute and graphic characters are protected characters. The control code sequences and a description of the Protect mode functions follows:

* Protect mode on (ESC &) --- Turns on the Protect mode. This is indicated on the status line by **PROT** and causes half intensity, graphics, and attribute characters to be protected from overwriting or erasure.

* Protect mode off (ESC ') --- Turns off the Protect mode. This is indicated on the Status Line by **PROT** being replaced by spaces.

* Write Protect on (ESC)) --- Turns on the Write Protect mode. Until the mode is reset, each character entered is displayed with half intensity. This is indicated on the Status line by **H.I.**

* Write Protect off (ESC () --- Turns off the Write Protect mode (resets Write Protect). All characters entered are displayed without half intensity. This is indicated on the status line by **H.I.** not being present. If used during Graphics mode, this command turns off the Graphics mode.

3.5.4 Editing and Cursor Control

The editing and cursor control key operation is described in section 3.2.2 page 25. Escape and Control sequences may be sent from the host to perform the various editing and cursor functions.

(1) Cursor Control

The cursor control code sequences and a description of the function follows:

* Cursor up (CTRL K) --- Moves the cursor up one line until it encounters the top of the screen. If the cursor is not on the first line of the page, the display will roll down one line each time until the cursor reaches the top of the page. Once it reaches the top of the page, further receipt of the code has no effect.

* Cursor down (CTRL V) --- Moves the cursor down one line. If the cursor is on the bottom line of the screen, the display will roll up one line. If the cursor is on the bottom line of the page, the code has no effect.

* Cursor left (CTRL H) --- Same as **BACKSPACE.** Moves the cursor left to the next unprotected position on the page. If the cursor is currently in the first column of the line, it will move to the last column of the preceding line or to that line. If Auto Page is off and the cursor is currently at the Home position or the first unprotected position on the page, the code has no effect.
  If Auto Page is on and the cursor is at the Home position or the first unprotected position on the page, the cursor will move to the end of the preceding page or to the last position of the last unprotected field of the preceding page. If the current page is page 0, the code has no effect.

* Cursor right (CTRL L) --- Moves the cursor right one column; if at column 80 or 132, it moves the cursor to the first column of the next line. With Auto Page off and the Protect mode off, it will cause a scroll if the cursor is at column 80 or 132 of the last line. With Auto Page on and the cursor at the last unprotected position on the page, the cursor will advance to the first unprotected position of the next page. If the page was the last, the cursor will advance to Home of the first page. With Auto Page off the Protect mode on and the cursor at the last unprotected position on the page, the cursor will move to the first unprotected position of the current page.

* Carriage return (CTRL M) --- Moves the cursor left to column 1 of the current line.

* Cursor Home (CTRL ^) --- Moves the cursor to the first unprotected character on the page.

* New line (CTRL _) --- Causes the terminal to perform a carriage return and a linefeed.

(2) Cursor Position Programming

To control the cursor position (To move the cursor to the specifed position) from the host, send the ESC seqrences

Address cursor to row, column:

ESC = p_1 p_2 p_3

where p_1 = the desired row (line)
p_2 = the desired column (low)
p_3 = the desired column (high)
(Note: p_3 need only in 132 column/line mode)

Address cursor to page, row, column:

ESC - p_1 p_2 p_3 p_4

where p_1 = the desired page number 0 - 3 (Page screen mode)
the desired page number 0 (Virtual screen mode)
p_2 = the desired row
p_3 = the desired column (low)
p_4 = the desired column (high)
(Note 1: p_4 needs only in 132 column/line mode)
(Note 2: If p_1 is 1 - 3 in Virtual screen mode, this Escape sequence is not effective.)

according to the cursor addressing codes (refer to Table 3.6 page 75).

(3) Normal and Reverse Linefeed

* Linefeed (CTRL J or **LINEFEED**) --- With Auto Page and the Protect mode off, a linefeed advances the cursor to the next line on the page. If the cursor is at the bottom of the screen, linefeeds cause the display to roll up one line for each lineteed. If the cursor is also at the bottom of the page, a linefeed causes a new line of data to appear at the bottom of the screen and results in the loss of the top line of data on the page. The new line contains the insert character. With the Protect mode off or on and Auto Page on, linefeed advances the cursor to the next line on the page. When it reaches the bottom of the page, it advances to the first line of the next page. When it reaches the last line of the last page, it advances to the first line of page 0. With the Protect mode on and Auto Page off, the cursor advances to the top of the current page when it reaches the bottom of the page.
* Reverse linefeed (ESC j) --- Moves the cursor up one line for each reverse linefeed received. If the Protect mode is on and Auto Page is off, the cursor stops when it reaches the top line of the page. If Auto Page is on and the Protect mode is on or off, the cursor moves to the last line of the previous page when it reaches the first line of the current page. If the cursor is at line 1 of page 0, it will not move. If the Protect mode and Auto Page are off, the screen will scroll down one line when the cursor reaches the top line of the screen.

If the cursor is also at the top of the page, the page will scroll down one line, causing a new line of data to appear at line 1 of the screen and deleting the last line of the current page. The data will consist of insert characters.

(4) Editing Control

The editing control sequences and a description of their functions follows:

* Set Local Edit mode (ESC k 1) --- Sets the edit keys (CHAR INS, CHAR DEL, LINE INS, LINE DEL, LINE ERASE, PAGE ERASE, SEND, PRINT, CLEAR SPACE, BACKSPACE, HOME, ↑ , ↓ , ->, <-, TAB, and BACKTAB) for local operation only. These keys will affect data in the terminal; characters associated with the keys will not be transmitted to the host. All other keys operate normally.

* Set Duplex Edit mode (ESC k 0) --- Sets the edit keys to operate in the mode set for the alphanumeric keys. For example, if the terminal is set for Half-duplex operation, the alphanumeric keys operate in Half-duplex mode, and the edit keys operate in Half-duplex mode.

* Set page edit (ESC N) --- Enables the wraparound feature for character insert, character delete, and insert modes. When a character is inserted in a line, the character in column 80 (or 132 in 132 column/line mode) moves to column 1 in the next line. If each line contains 80 (or 132) characters, this control causes a ripple effect, and results in the loss of the character in the last column of the last line of the page.
When deleting a character, the character in column 1 of each line moves to column 80 (or 132) of the previous line. EDTP or INSP will be indicated on the Status Line. The Protect mode will be always turn the Edit Page mode off.

* Clear page edit (ESC O) --- Clears the Edit Page mode. When Edit Page is cleared, character insert affects only the cursor line; no wraparound occurs. An inserted character causes each character in the line after the insertion to move right one column; the character at column 80 (or 132 in 132 column/line mode) is then lost. For a character delete, the last character on the line (at column 80 or 132) becomes an insert character. EDTL or INSL will be indicated on the status line.

* Character insert (ESC Q) --- Causes the character at the cursor to move right one column and enters an insert character at the cursor position. If the terminal is set to Edit Page, the character at column 80 (or 132 in 132 column/line mode) wraps to column 1 of the next line (as described above). If the terminal is set to Edit Line, the character at column 80 (or 132) is lost. If the Protect mode is on, this control will turn off Edit Page. A character insert will insert from the cursor position to the end of the line or to the first protected field.

* Character delete (ESC W) --- Deletes the character at the cursor position and moves all following characters left one position. At the end of the delete function, an insert character is written into the last position on the line. If Edit Page is set, the character in column 1 of the next line moves back to column 80 (or 132 in 132 column/line mode) of the previous line (as described above). The last position on the page is loaded with an insert character.
If Protect mode is on, character delete operates only in the Edit Line mode from the cursor position to the end of the unprotected field or line.

* Set insert mode (ESC q) --- Sets automatic character insertion. This mode operates like Character Insert, except that a typed alphanumeric character is automatically inserted on the screen at the cursor position. This causes all characters to the right of the cursor to move one column to the right.
If Edit Page is set, the character in column 80 (or 132 column/line mode) moves to column 1 of the next line. The character at the end of the line or at the end of the page is lost. INSL or INSP will be indicated on the Status Line.

* Clear insert mode (ESC r) --- Clears the Insert mode. EDTL or EDTP will be indicated on the Status Line.

3.6 Page Control

The 6402G has two screen control modes: Page screen and Virtual screen modes.

Set Page screen mode: ESC V 4 0

In Page screen mode, the 6402G holds up to maximum 96 lines in memory, which may be divided into four 24-line pages, two 48-line, a single 72-line, a single 96-line page. These pages may be incremented forward or backward one page at a time. When incremented or decremented, the cursor assumes the last position previously occupied on that page. To control the paging functions, enter the following codes in the exact sequence shown below:

Set lines per page	ESC \ p_1	where p_1 = 1 for 24 2 for 48 3 for 72 4 for 96
Advance page	ESC K	
Back page	ESC J	
Print page and display next page	ESC P or ESC L	
Auto page on	ESC v	
Auto page off	ESC w	

3.7 Clear Function

The 6402G Clear function is used in one of four ways to clear data from screen memory and/or host memory. The clear function Escape codes and a description of their functions follow:

* Clear unprotected data to nulls (ESC :) --- Clears all unprotected data on the page to the null character (or Half Intensity nulls if set).

* Clear unprotected data to insert character (ESC ; or ESC + or CTRL Z) --- Clears all unprotected data on the page to the insert character. If Write Protect (H.I.) is set, the screen will be cleared to half intensity insert characters.

* Clear page to half intensity spaces (ESC ,) --- Clears all unprotected data on the page to half intensity spaces.

* Clear all to null (ESC *) --- Clears all data on the page to nulls and resets the Write Protect (H.I.), Graphic and Protect mode.

3.8 Using Tabs

The 6402G uses two types of tabs: typewriter tabs that move the cursor anywhere tabs are set and field tabs that move the cursor across protected fields.

3.8.1 Typewriter Tabs

Typewriter tabs may be set anywhere on the 6402G page. When the page is set for normal video (**PROT** off), the tabs act like typewriter tabs, advancing the cursor to the next tab position. Each time **TAB** is pressed the cursor advances to the next tab; each time **BACK TAB** is pressed, the cursor backs to the previous tab. If the cursor is beyond the last tab set on a line, pressing **TAB** has no effect. When the cursor is at the first tab on a line, pressing **BACK TAB** moves it to the first column of the line.

3.8.2 Field Tabs

Tabs may be set protected (**PROT** on) to act on a field basis. The cursor will not move to previously set typewriter tab columns. Pressing **TAB** moves the cursor to the first unprotected character position following the next protected field. If Auto page is off (refer to section 3.6 page 39) and no unprotected character follows, the cursor moves to the first unprotected character on the same page. If Auto Page is on and there is no following unprotected character, the cursor moves to the first unprotected character of the next page. If the next page contains no protected fields, the cursor moves to the Home position (line 1, column 1) on that page.

3.8.3 Tab Operations

To move the cursor forward to a tab position, press **TAB** (CTRL I). To move the cursor back to a previous position, press **BACK TAB** (ESC I).

To set or clear the tabs, enter the code for the desired operation. Type the code in the exact sequence shown below:

Operation	Code
Tab set	ESC 1
Clear tab at cursor	ESC 2
Clear all tabs	ESC 3

3.8.4 Tab Programming

The cursor may be moved on the screen to preset typewriter-style tabs or to field tabs if the Protect mode is set. The control code sequences and a description of the tab operations follows:

* Set tab (ESC 1) --- When the 6402G is set to the Protect mode, the code generates a vertical column of half intensity spaces from the cursor position down to the first write-protected character or to the end of the page, whichever is first. When the Protect mode is off, the code sets a typewriter-style column tab.

* Clear tab (ESC 2) --- Clears the typewriter tab at the cursor column. The code has no effect when the Protect mode is set.

* Clear all tabs (ESC 3) --- Clears all the typewriter-style tabs set on a page. The code has no effect when the Protect mode is set.

* Tab (protect and unprotect ... ESC i, CTRL I) --- When the Protect mode is off, the code causes the cursor to advance through the next typewriter-style tab set. If no tabs are set, the code has no effect and the cursor will not move. When the protect mode is set, the cursor is moved to the first unprotected character following the next protected field.
  If Auto Page is off and there are no following unprotected fields, the cursor moves to the first character of the first unprotected field at the top of the page. If there are no characters on the page, the cursor will move to Home position. If Auto Page is on and no unprotected field follows, the cursor will advance to the first unprotected character on the next page. If no unprotected field exists on the next page, the cursor moves to Home position on that page.

* Back tab (ESC I) —— When the Protect mode is off, the code causes the cursor to back to the previous tab position set. If no tabs are set or if the cursor is on the first tab position on the page, Back Tab moves the cursor to the first column on the line.
It the Protect mode is set and Auto Page is off, Back Tab moves the cursor back to the start of the first preceding unprotected field. If no preceding positions exist, the cursor will not move.
If Auto Page and the Protect mode are on and the cursor is in the first unprotected position on the page, the cursor backs to the start of the last unprotected field on the previous page.
If the cursor is at the first unprotected position on page 0, the code has no effect. If on protected fields exist on a page, Home position is considered the start of as unprotected field.

3.9 Graphics

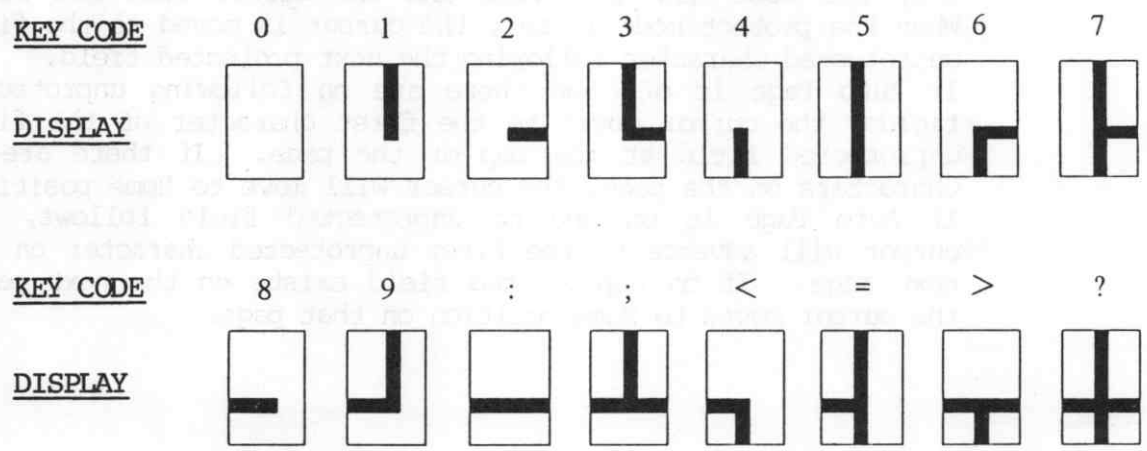
3.9.1 Special-graphics Characters

The 6402G provides a special-graphics feature that converts any alpha-numeric character received to 1 of 16 graphic characters. The graphics mode status is indicated in the status line with GRPH for on and a space or H.I. (if Write Protect (H.I.) was previorsly set) in the same position for off. To control the graphics mode, use the following code sequence:

Graphics on	ESC $
Graphics off	ESC %

Refer to Figure for the graphics characters and their corresponding alpha-numeric characters.

Table 3.1 Special-graphics Characters

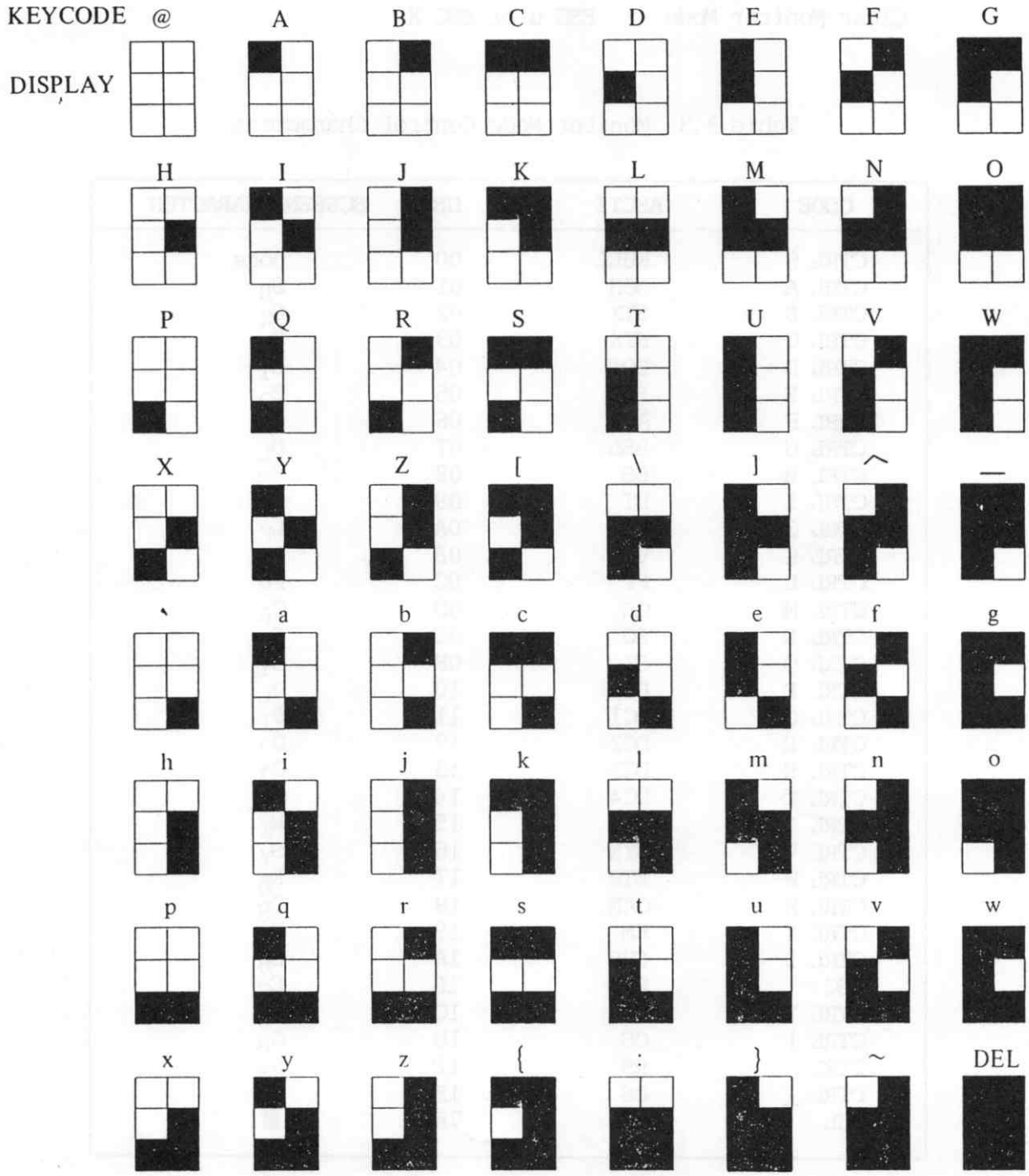


Note: If sent during H.I. mode, graphics off command turns off H.I. mode.

3.9.2 Semi-graphics Characters

The 6402G provides a semi-graphics feature.
In graphic mode, alpha-numeric characters are converted into semi-graphics characters as follows:

Table 3.2 Semi-graphics Characters



3.10 Monitor Mode

The 6402G provides a Monitor mode for displaying all characters received from the host or entered on the keyboard, including Escape and Control sequences (see Table 3.3). The Escape and Control sequences on the screen will provide visual cues in long program routines. To control the Monitor mode, use the following code sequences:

Set Monitor Mode	ESC U
Clear Monitor Mode	ESC u or ESC X

Table 3.3 Monitor Mode Control Characters

CODE	ASCII	HEX	SCREEN CHARACTER
CTRL @	NULL	00	none
CTRL A	SOH	01	S_H
CTRL B	STX	02	S_X
CTRL C	ETX	03	E_X
CTRL D	EOT	04	E_T
CTRL E	ENQ	05	E_Q
CTRL F	ACK	06	A_K
CTRL G	BEL	07	B_L
CTRL H	BS	08	B_S
CTRL I	HT	09	H_T
CTRL J	LF	0A	L_F
CTRL K	VT	0B	V_T
CTRL L	FF	0C	F_F
CTRL M	CR	0D	C_R
CTRL N	SO	0E	S_O
CTRL O	SI	0F	S_I
CTRL P	DLE	10	D_L
CTRL Q	DC1	11	D_1
CTRL R	DC2	12	D_2
CTRL S	DC3	13	D_3
CTRL T	DC4	14	D_4
CTRL U	NAK	15	N_K
CTRL V	SYN	16	S_Y
CTRL W	ETB	17	E_B
CTRL X	CAN	18	C_N
CTRL Y	EM	19	E_M
CTRL Z	SUB	1A	S_B
ESC	ESC	1B	E_C
CTRL \	FS	1C	F_S
CTRL]	GS	1D	G_S
CTRL ^	RS	1E	R_S
CTRL _	US	1F	U_S
DEL	DEL	7F	■

3.11 WordStar Mode

The terminal provides two type modes; "WordStar mode" and 6402G mode. You can choose either by an ESC sequence:

ESC] n

where n = 1 WordStar mode on
0 WordStar mode off
(6402G mode)

In WordStar mode, the operating mode is changed to FDX mode, the Duplex Edit mode is set, and the message "W.S." is displayed on the Status Line. The transmission code is different from 6402G code (see Table 3.5 page 74).

Note: Operate in only FDX mode, and the operation is not guaranted in the other modes.

3.12 Function Key Programming

The memory assigned to the function keys can hold up to 256 bytes (or characters) total. For each message entered, an extra character byte is added by the 6402G processor for control purposes. The number of characters that may be entered per key equals 256 bytes minus the number of keys programmed minus the total bytes for all keys already been programmed minus 1. For example, it three keys have already been programmed with four characters each, then the next key may be programmed with up to 239 characters; that is

256 bytes
- 3 bytes (extra characters) for keys already programmed
- 1 byte (extra character) new key
- 12 bytes total already programmed
- 1 byte (buffer end indicator)
= 239 bytes left that may be programmed.

Until you reprogram a function key, the function keys are programmed with default messages set to Full-duplex mode.
These default message codes are as follows:

Key	Code	Shifted Code
F1	CTRL A @ CR	CTRL A ` CR
F2	CTRL A A CR	CTRL A a CR
F3	CTRL A B CR	CTRL A b CR
F4	CTRL A C CR	CTRL A c CR
F5	CTRL A D CR	CTRL A d CR
F6	CTRL A E CR	CTRL A e CR
F7	CTRL A F CR	CTRL A f CR
F8	CTRL A G CR	CTRL A g CR
F9	CTRL A H CR	CTRL A h CR
F10	CTRL A I CR	CTRL A i CR
F11	CTRL A J CR	CTRL A j CR

The name "WordStar" is a trademark of MicroPro International Corporation.

To program the function keys, use the following ESC sequence:

ESC ¦ p_1 p_2 message CTRL Y

where p_1 is the number of the function key. The values of p_1 are as follows:

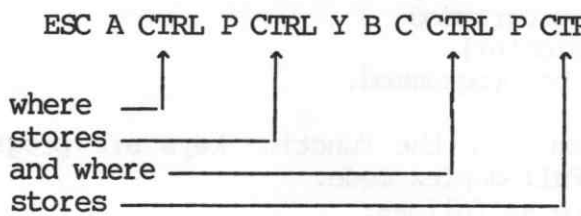
Key	Normal	Shifted
F1	1	<
F2	2	=
F3	3	>
F4	4	?
F5	5	@
F6	6	A
F7	7	B
F8	8	C
F9	9	D
F10	:	E
F11	;	F

and where p_2 is a 1 (send to a host - FDX), 2 (send to screen - LOC), or 3 (send to host and to screen - HDX).

Because CTRL Y (terminator) and CTRL P (for the following explained function) are not normally stored, a CTRL P imbedded in the text of the function key message may be used to store the next character entered. For example, if the desired message is:

ESC A CTRL Y B C CTRL P

proceed it with ESC ¦ the key number, and the transmission mode (see above), then enter it as



and then complete the load sequence with the CTRL Y load terminator.

Once the function keys have been programmed, just press the desired key (for the first message programmed) or the desired key and **SHIFT** key at the same time (for desired key the second message programmed).

Note: The character for message can be used only ASCII code.

3.13 Send Function

The **SEND** key may be programmed to transmit line of page data. The key operates both unshifted and shifted for transmission of two character Escape sequences. Transmission of text data by the **SEND** key may include the use of embedded delimiters that define fields, ends of lines, and the end of text.

(1) Delimiter Programming

To program delimiters, enter the following code in the exact sequence shown below:

ESC x p_1 p_2 p_3

Set Send delimiters, where p_1 =
0 for delimit field code to p_2 p_3
1 for delimit line code to p_2 p_3
2 for delimit start protect field to p_2 p_3
3 for delimit end protect field to p_2 p_3
4 for delimit end of text to p_2 p_3

Where p_2 p_3 each = any standard ASCII or control character. From the keyboard **ESC** and not **LOC ESC** is needed for an ESC delimiter.

The delimiter initial (factory default) values are as follows:

Delimiter	**Code**
Field	p_2 = FS, p_3 = null
Line	p_2 = US (only p_2)
Start-protected field	p_2 = ESC, p_3 =)
End-protected field	p_2 = ESC, p_3 = (
End of text	p_2 = Carriage return, p_3 = null

(2) Loading the **SEND** key

To load the **SEND** key, enter the following code in the escape sequence shown below:

ESC 0 p_1 p_2 where p_1 = 0 for **SHIFT SEND**,
and 1 for **SEND**.

and where p_2 = 4 to program ESC 4
5 to program ESC 5
6 to program ESC 6
7 to program ESC 7
S to program ESC S
s to program ESC s
^ to program ESC ^
_ to program ESC _

Until you reload the **SEND** key, it is loaded with the initial (factory default) values of ESC 7 for unshifted and ESC 6 for shifted. The **SEND** key escape codes and a description of their functions follow:

* Send line unprotected (ESC 4) --- Sends all unprotected data on a line from column 1 through to the cursor position. The code also sends field delimiters in place of protected fields and an end-of-text delimiter at the end of the send transmission.

* Send page unprotected (ESC 5) --- Sends all the unprotected data on page from Home through to the cursor position. It sends field delimiters in place of protected fields. The code also sends a line delimiter at the end of a line and an end-of-text delimiter at the end of the send transmission.

* Send line all (ESC 6) --- Sends all data from the first column through the cursor position. It also sends the start-protected field and end-protected field delimiters at the start and end, respectively, of each protected field. If the character at the cursor position is protected, the terminal sends an end-protected field delimiter to the host. The code sends the end-of-text delimiter at the end of the send transmission.

* Send page all (ESC 7) --- Sends all data on the page from Home through to the cursor position. It also sends the start-protected field and end-protected field delimiters at the start and end, respectively, of each protected field. If the character at the cursor position is protected, the terminal sends an end-protected field delimiter to the host. This code also sends the end-of-text delimiter at the end of the send transmission.

* Send message unprotected (ESC S) --- Sends all unprotected data bracketed by the STX and ETX codes displayed on a page. After the data is sent, the terminal positions the cursor at the ETX code. If the page contains no STX codes, transmission begins from Home. If the page contains no ETX code, the terminal sends to the end of the page and positions the cursor at Home after the data is sent. If the page contains neither an STX nor an ETX code, the entire page will be sent. The code sends field delimiters in place of protected fields. It also sends line delimiters at the end of each line and an end-of-text delimiter at the end of the send transmission.

* Send message all (ESC s) --- Operates in the same manner as ESC S, except that protected fields delimited by start-protected field and end-protected field are also transmitted.

* Send SOM unprotected (ESC ^) --- Send all unprotected data from the SOM position through to the cursor position. If there is no SOM position on the page, the terminal send all unprotected data located from the home position to the cursor. The code sends field delimiters in place of protected fields. It also sends line delimiters at the end of each line and an end-of-text delimiter at the end of the send transmission. After sending data, the cursor position doesn't change.

* Send SOM all (ESC _) --- Send all data from SOM position through the cursor position. Operate in the same manner as ESC ^, except that protected fields delimited by start-protected field and end-protected field are also transmitted.

The way to set SOM position is as follows:

a. Move cursor to the position to be set SOM.
b. Receive SOH code $(01)_{16}$ from host (or key in).

(3) Send User Line
The 6402G is commanded to send the data loaded into its User Line by entering

ESC Z 0

The terminal will send the User Line data, followed by a carriage return, to the host.

(4) Send Status Line
The 6402G is commanded to send Status Line information to the host by entering

ESC Z 1

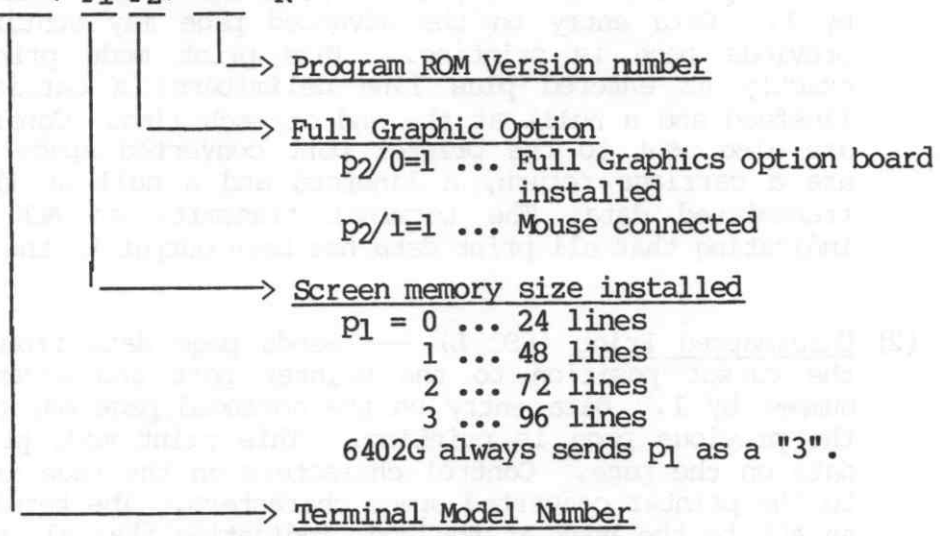
The terminal will send the Status Line data, followed by a carriage return, to the host.

(5) Send Terminal I.D.
The 6402G is commanded to send Terminal Identification information to the host by entering

ESC Z 2

The terminal will send the terminal identification information by the following data format.

7381, p_1 p_2, v.r C_R


Program ROM Version number
Full Graphic Option
p2/0=1 ... Full Graphics option board installed
p2/1=1 ... Mouse connected
Screen memory size installed
p1 = 0 ... 24 lines
1 ... 48 lines
2 ... 72 lines
3 ... 96 lines
6402G always sends p1 as a "3".
Terminal Model Number

(6) Send Cursor Position

The 6402G may be commanded to send the current cursor position to the host. The cursor position may be sent as page, row, and column, or as just row and column. In either case, the position information will be automatically followed with end-of-text delimiter. The Escape code sequences and a description of their functions follow:

* Send cursor row and column (ESC ?) --- Sends the cursor's current line (row) and column position as specified in the cursor addressing table.

* Send cursor page, row, and column (ESC /) --- Sends the cursor's current page, line, and column position. 0 is sent for page zero, and 1 for page one 2 for page two, and so forth. Row and column are sent as specified in the cursor addressing table.

Note: If Virtual screen mode is set, the terminal sends 0 for cursor page.

3.14 Print Function

The 6402G printer port may be set for terminal page data transmission, data transmission from the host, or two-way communications between a KSR-type printer and host. If during a print operation (PRT 0 --- PRT 3) the device connected to the printer port cannot accept any more data, the device may signal the terminal to stop sending data by setting pin 20 of the printer port (refer to section 5.2 page 119) to - 12 Vdc or by sending X-OFF (DC3) on pin 2 of the printer port. The device may then request the transmission of more data by setting the pin 20 to + 12 Vdc or by sending X-ON (DC1) on the pin 2.
The print function control sequences and their descriptions follow:

(1) Page print (ESC P) --- Sends page data from Home through the cursor position to the printer port and advances the page number by 1. Data entry on the advanced page may continue while the previous page is printing. This print mode prints page data exactly as entered plus line delimiters (a carriage return, a linefeed and a null) at the end of each line. Control characters are also sent to the printer port converted space characters as are a carriage return, a linefeed and a null at the end of the transmitted data. The terminal transmits an ACK to the host indicating that all print data has been output to the printer port.

(2) Unformatted Print (ESC L) --- Sends page data from Home through the cursor position to the printer port and advances the page number by 1. Data entry on the advanced page may continue while the previous page is printing. This print mode prints only the data on the page. Control characters on the page are transmitted to the printer converted space characters. The terminal transmits an ACK to the host at the end, indicating that all print data has been output to the print port.

(3) Copy print mode

* Copy print mode on (ESC @) --- Causes all subsequent data received by the terminal to be sent to the screen and to the device connected to the printer port at selected printer baud rate.

* Copy print mode off (ESC A) --- Turns off the Copy Print mode. Screen updating continues normally; data remaining in the print buffer continues to be outputted to the printer port until the buffer is empty.

* Print buffer control --- All print data goes first to the terminal receive buffer and then to the terminal print buffer. The two terminal buffers have a capacity of 512 characters. When the receive buffer is almost full (less than 16 characters), the terminal sends X-OFF to the host (or toggles the DTR low). When the buffer empties, the terminal sends X-ON to the host (or toggles the DTR high).

* The X-ON/X-OFF feature allows communicating with the host at a high baud rate and outputting data to a printer port device at a low baud rate.

(4) Buffer print mode

* Buffer print mode on (ESC a 1) --- Sends all subsequent data received by the terminal (including control and escape characters) to output to the printer port transparently. Print buffer control is identical to the Copy Print mode.

* Buffer print mode off (ESC a 0) --- Turns off the Buffer Print mode. Data remaining in the buffers will continue to be sent to the printer port until the print buffer empties.

(5) Bidirectional mode

* Enable bidirectional mode (CTRL R) --- Enables bidirectional communication between devices attached to the terminal's main and printer ports. Data sent from the host goes to the screen and terminal's printer. Data sent from a KSR printer to the host passes through the terminal but does not affect it. Does not display data sent through the printer port to the main port.

  Note: Both devices attached to the terminal must use the same baud rate, parity, word length, and stop bits.

* Disable bidirectional mode (CTRL T) --- Turns off bidirectional communication between terminal ports.

3.15 Main Port Programming

When the terminal is turned on, the operating parameters of the host RS232C port are set on NVRAM information (refer to section 2.5 page 10). The parameters may, however, be changed with Escape sequences after power up. To change the parameters, enter

ESC { p_1 p_2 p_3 p_4 where p_1 = baud rate
p_2 = number of stop bits
p_3 = parity
p_4 = data length.

To specify parameter p_1 (baud rate), enter:

0 for	9600 baud	8 for	1200 baud
1 for	50 baud	9 for	1800 baud
2 for	75 baud	: for	2400 baud
3 for	110 baud	; for	3600 baud
4 for	135 baud	< for	4800 baud
5 for	150 baud	= for	7200 baud
6 for	300 baud	> for	9600 baud
7 for	600 baud	? for	19200 baud.

To specify parameter p_2 (number of stop bits), enter:

0 for 1 stop bit
1 for 2 stop bits.

To specify parameter p_3 (parity), enter:

0 for parity disabled, parity ignored
1 for odd parity, receive and transmit
3 for even parity, receive and transmit
5 for mark parity, transmit parity check disabled
7 for space parity, transmit parity check disabled.

To specify parameter p_4 (data length), enter:

0 for 8 bits
1 for 7 bits.

For example, to set the baud rate to 4800, the number of stop bits to 2, parity to even, and data length to 7, enter

ESC { < 131 where < = 4800 baud
1 = 2 stop bits
3 = even parity
1 = 7-bit data length.

3.16 Printer Port Programming

When the terminal is turned on, the operating parameters of the printer RS232C port (like the host port parameters) are set on NVRAM information (refer to section 2.5 page 10). However, the parameters may be changed with Escape sequences after power up. To change these parameters, enter

ESC } p_1 p_2 p_3 p_4 where p_1 = baud rate
p_2 = number of stop bits
p_3 = parity
p_4 = data length.

The parameter codes for the printer port are identical to the codes used for the host port (refer to section 3.15 page 52).

3.17 User Line Programming

The 6402G provides a line that may be programmed with user data. When displayed, it replaces the Status Line on line 25 (see Figure 2.3 page 6). The line may be loaded with up to 80 (or 132 in 132 column/line mode) characters. Both the Status and User Lines may be transmitted to the host (see ESC Z page 49).
To load the User Line and send the Status Line or the User Line to the host, proceed as follows:

(1) Press **ESC g** to display the User Line.
(2) Press **ESC f.**
(3) Enter up to 80 (or 132) characters of text. The message will appear on the User Line as it is entered.
(4) Press **RETURN** to terminate the user message.
(5) To send the User Line message to the host, press **ESC Z 0** in sequence.
(6) To redisplay the Status Line on line 25, press **ESC h.**
(7) To send the Status Line to the host, press **ESC Z 1** sequentially.

3.18 X-ON, X-OFF Control

The 6402G automatically transmits **X-OFF** to the host, which requests the host to stop sending data when the terminal's receive buffer is almost full (less than 16 characters). When the data in the buffers is processed (output to the screen or to the printer buffer), the 6402G automatically transmits **X-ON** to the host, which indicates that the host may resume sending data to the terminal (refer to section 3.14(3) page 51). The **X-ON, X-OFF** feature may be enabled or disabled with the following Control sequences:

Enable X-ON, X-OFF	CTRL O
Disable X-ON, X-OFF	CTRL N

3.19 Wraparound Feature

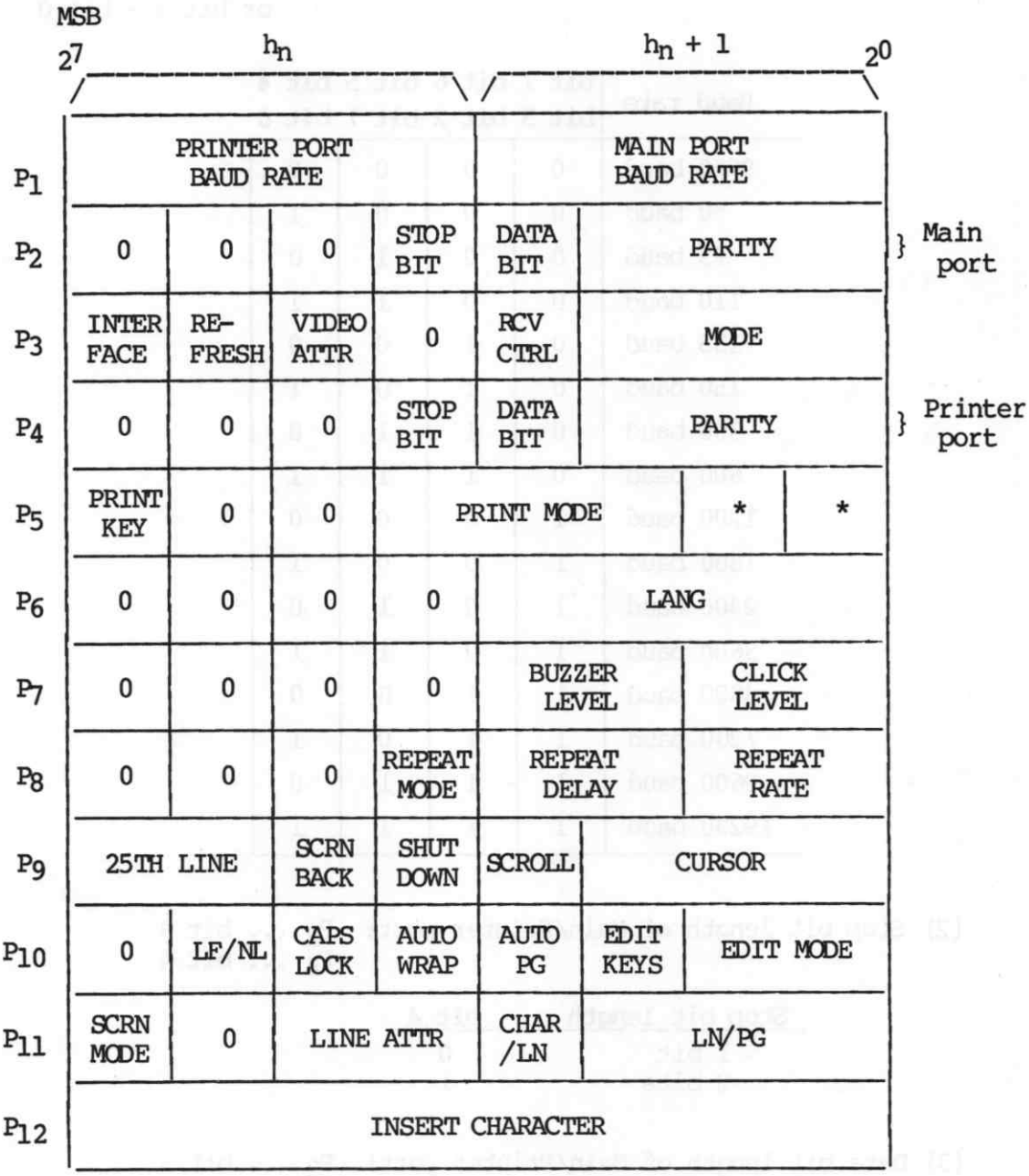
The 6402G contains a wraparound feature, in which entered text automatically advances to column 1 of the next line when column 80 (or 132 in 132 column/line mode) of the previous line is reached. Because of this feature, the first LF entered after wrapping past column 80 (or 132) (but before any text is entered) will be ignored by the terminal. Ignoring this LF prevents a double linefeed when the terminal receives 80 (or 132) characters, CR, LF, 80 (or 132) characters, CR, LF, and so forth.

3.20 Send System Status Information

The 6402G has the capability to send the current contents of the NVRAM to the host. To do this, enter the following sequence:

ESC ~

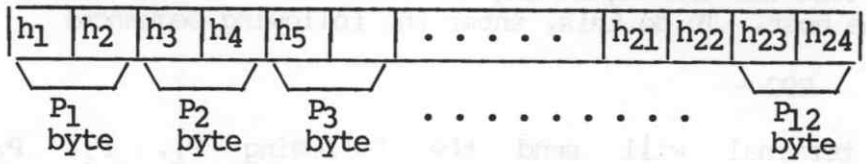
The terminal will send the following P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12} information to the host as shown below.



*: don't care

The above current system status information bytes: P_1 - P_{12} are sent to host as twelve pairs of hex-code.

Sending data format



The detailed bit configurations of each information are shown below.

(1) Baud rate for Main/Printer port: P_1 byte ... bit 7 - bit 4
or bit 3 - bit 0

Baud rate	bit 7	bit 6	bit 5	bit 4 / bit 3	bit 2	bit 1	bit 0
9600 baud	0	0	0	0			
50 baud	0	0	0	1			
75 baud	0	0	1	0			
110 baud	0	0	1	1			
135 baud	0	1	0	0			
150 baud	0	1	0	1			
300 baud	0	1	1	0			
600 baud	0	1	1	1			
1200 baud	1	0	0	0			
1800 baud	1	0	0	1			
2400 baud	1	0	1	0			
3600 baud	1	0	1	1			
4800 baud	1	1	0	0			
7200 baud	1	1	0	1			
9600 baud	1	1	1	0			
19200 baud	1	1	1	1			

(2) Stop bit length of Main/Printer port: P_2 ... bit 4
P_4 ... bit 4

Stop bit length	bit 4
1 bit	0
2 bits	1

(3) Data bit length of Main/Printer port: P_2 ... bit 3
P_4 ... bit 3

Data bit length	bit 3
7 bits/char	0
8 bits/char	1

(4) PARITY definition for Main/Printer port: P_2 ... bit 2 - bit 0
P_4 ... bit 2 - bit 0

Parity definition	bit 2	bit 1	bit 0
Non-parity	X	X	0
Odd parity	0	0	1
Even parity	0	1	1
Mark parity	1	0	1
Space parity	1	1	1

(5) Line interface for Main port: P_3 ... bit 7

Line interface type	bit 7
RS232C	1
Current loop	0

(6) Screen refresh rate: P_3 ... bit 6

Refresh rate	bit 6
50 Hz	0
60 Hz	1

(7) Video attribute: P_3 ... bit 5

Video attribute	bit 5
Serial field	0
Parallel character	1

(8) Receiving buffer control for Main port: P_3 ... bit 3
(Data hand-shake)

Data hand-shake	bit 3
X-ON/OFF control	1
DTR line control	0

(9) Transmission mode: P_3 ... bit 2 - bit 0

Transmission mode	bit 2	bit 1	bit 0
Half-duplex	0	0	0
Full-duplex	0	0	1
Block	X	1	X
Local	1	0	X

(10) Print key: P_5 ... bit 7

Print key	bit 7
Duplex edit	0
Local edit	1

(11) Print mode: P_5 ... bit 4 - bit 2

Print mode	bit 4	bit 3	bit 2
Non-print mode	0	0	0
Copy print mode	X	X	1
Buffer print mode	X	1	0
Bidirectional mode	1	0	0

(12) Language variant selection: P_6 ... bit 3 - bit 0

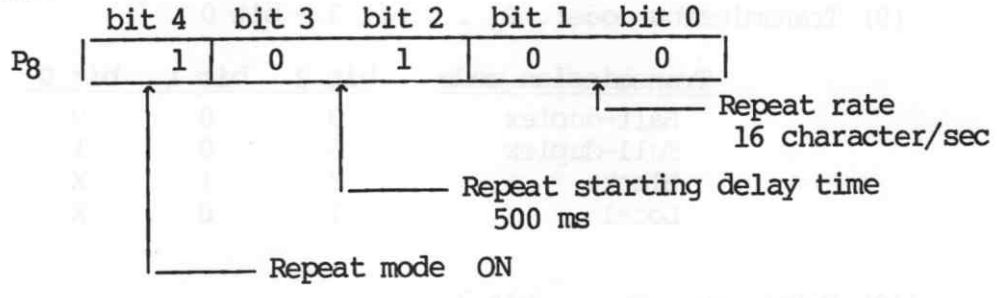
Language selection	bit 3	bit 2	bit 1	bit 0
U.K.	0	0	0	0
U.S.A.	0	0	0	1
GERMAN	0	0	1	0
FRENCH	0	0	1	1
SWEDISH/FINNISH	0	1	0	0
DANISH/NORWEGIAN	0	1	0	1
DUTCH	0	1	1	0
ITALIAN	0	1	1	1
SPANISH	1	0	0	0
PORTUGUESE	1	0	0	1
CANADIAN FRENCH	1	0	1	0

(13) Buzzer level/Click level: P_7 ... bit 3, 2
bit 1, 0

Sound level	bit 3 bit 1	bit 2 bit 0
non	0	0
Low	0	1
Medium	1	0
Loud	1	1

(14) Repeat control: P_8 ... bit 4 - bit 0

The 6402G has prefixed default values for the keyboard repeat control.



(15) 25th line display mode: P_9 ... bit 7, 6

25th line definition	bit 7	bit 6
Non-displayed	0	X
Status Line	1	0
User Line	1	1

(16) Screen background: P_9 ... bit 5

Screen background	bit 5
Dark background	0
Light background	1

(17) Screen auto shut-down: P_9 ... bit 4

Screen auto shut-down	bit 4
Auto shut-down OFF	0
Auto shut-down ON	1

(18) Scrolling class: P_9 ... bit 3

Scrolling	bit 3
Pop scrolling	0
Smooth scrolling	1

(19) Cursor attribute: P_9 ... bit 2 - bit 0

Cursor attribute	bit 2	bit 1	bit 0
Invisible	0	X	X
Block-blink	1	0	0
Block-steady	1	0	1
Underline-blink	1	1	0
Underline-steady	1	1	1

(20) Linefeed code operation: P_{10} ... bit 6

Operation	bit 6
Linefeed	0
New line	1

(21) CAPSLOCK status default value: P_{10} ... bit 5

Power on default value	bit 5
Capslock ON	1
Capslock OFF	0

(22) Auto-wraparound control: P_{10} ... bit 4

Wraparound control	bit 4
Auto-wraparound mode	1
Non-auto-wraparound mode	0

(23) Auto paging control: P_{10} ... bit 3

Paging control	bit 3
Auto Page ON	1
Auto Page OFF	0

(24) Edit keys transmission mode: P_{10} ... bit 2

Transmission mode	bit 2
Duplex edit	0
Local edit	1

(25) Edit mode: P_{10} ... bit 1, 0

Edit mode	bit 1	bit 0
Edit Line (EDTL)	0	1
Edit Page (EDTP)	0	0
Insert Line (INSL)	1	1
Insert Page (INSP)	1	0

(26) Screen control mode: P_{11} ... bit 7

Screen control mode	bit 7
Page screen mode	0
Virtual screen mode	1

(27) Default line attributes: P_{11} ... bit 5, 4

Default line attribute	bit 5	bit 4
Single width single height	0	0
Single width double height	0	1
Double width single height	1	0
Double width double height	1	1

(28) Column number/line: P_{11} ... bit 3

Column number/line	bit 3
80 column/line	0
132 column/line	1

(29) Line number/page: P_{11} ... bit 2, 1, 0

Line/page	bit 2	bit 1	bit 0
24 line/page	0	0	1
48 line/page	0	1	0
72 line/page	0	1	1
96 line/page	1	0	0

3.21 Edit Key Programming

The following Edit keys and function keys can be reprogrammed according to user applications. Word Star is are of the sample applications. These keys can also operate in both unshifted and shifted modes for transmittal of two or three characters.

ESC 0 P_1 P_2 P_3 P_4

where P_1 = edit key code (refer to Table 3.4)

P_2 P_3 P_4 = Programming data for the key (ASCII code 3 characters)

Table 3.4 Edit Key Codes

Edit Key	Pl	Default Value		
UNSHIFTED				
HOME	@	1E	00	00
↓	A	16	00	00
↑	B	0B	00	00
<-	C	08	00	00
->	D	0C	00	00
BACK SPACE	E	08	00	00
TAB	F	09	00	00
BACK TAB	G	1B	49	00
CLEAR	H	1A	00	00
CHAR INS	I	1B	51	00
CHAR DEL	J	1B	57	00
LINE INS	K	1B	45	00
LINE DEL	L	1B	52	00
LINE ERASE	M	1B	54	00
PAGE ERASE	N	1B	59	00
PRINT	O	1B	50	00
SEND	P	1B	37	00
ENTER	Q	0D	00	00
RETURN	R	0D	00	00
LINEFEED	S	0A	00	00
SHIFTED				
HOME	'	1E	00	00
↓	a	0A	00	00
↑	b	1B	6A	00
<-	c	1B	4D	4C
->	d	1B	4D	52
back space	e	08	00	00
TAB	f	09	00	00
BACK TAB	g	1B	49	00
CLEAR	h	1B	2A	00
CHAR INS	i	1B	71	00
CHAR DEL	j	1B	72	00
LINE INS	k	1B	4E	00
LINE DEL	l	1B	4F	00
LINE ERASE	m	1B	74	00
PAGE ERASE	n	1B	79	00
PRINT	o	1B	4C	00
SEND	p	1B	36	00
ENTER	q	0D	00	00
RETURN	r	0D	00	00
LINEFEED	s	0A	00	00

Note: NULL codes are ignored.

3.22 Cursor Attribute Function

The cursor may appear in any one of five ways. To set the cursor attribute, enter the control code for the desired attribute:

ESC . n

n = 0 Invisible cursor
1 Block Blinking cursor
2 Block Steady cursor
3 Underline Blinking cursor
4 Underline Steady cursor

3.23 Line Attributes

Line attributes are display features that affect a complete line of the display. The cursor selects the line to be affected by the line attribute.
The cursor does not change its character position when the line attribute is changed. However, if the cursor would be moved past the right margin by the line attribute, the cursor stops at the right margin. When lines are moved on the screen by scrolling, the line attribute is moved with the line.

The line attributes are selected by using the following sequences.

* Single width single height — ESC V 2 0
  Causes the line with the cursor to become single-width, single-height.

* Single width double height — ESC V 2 1
  Causes the line with the cursor to become single-width, double-hight.

* Double width single height — ESC V 2 2
  Causes the line with the cursor to become double-width, single-height.

* Double width double height — ESC V 2 3
  Causes the line with the cursor to become double-width, double-height.

Note: If an entire line is cleared using a clear command sequence, the line attribute is changed to default attribute.

3.24 Scrolling

Scrolling is the upward or downward movement of existing lines of characters on the screen. Scrolling is performed to make room for more lines of characters to be added to either the top or bottom of the scrolling region.
The following Escape sequence enables to select the one of two types scrolling: smooth scrolling, jump scrolling.

ESC 8 n

where n = 0 Select jump scrolling mode
1 Select smooth scrolling mode

Note: When the transmission baud rate is set at 19.2 k-baud, the terminal automatically is set in jump scrolling mode.

3.25 Scrolling Region

Scrolling Region is the area of the screen between the top and bottom margins. The top and bottom margins determine which lines on the screen are moved during scrolling.
The top and bottom margins of the scrolling region are defined by the following sequence.

ESC ! p_1 p_2

where p_1 = the line number of the first (top) line in the scrolling region
p_2 = the line number of the last (bottom) line in the scrolling region

according to the cursor addressing codes (refer to Table 3.6 page 75).

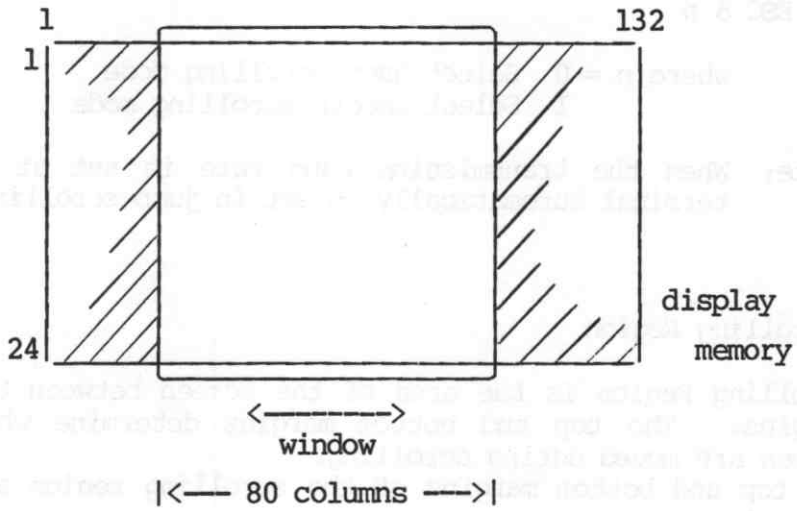
Each value represents a vertical position on the screen as if each of the 24 lines displayed were single height lines.

Note: The cursor can be set only in the scrolling region. Therefore, the data in the non-scrolling region (line locked) can not be replaced.

Page change (ESC K, ESC J), page print (ESC P, ESC L), and address cursor to page, row, column (ESC -) commands reset scrolling region.

3.26 Horizontal Scrolling (132 columns per line mode)

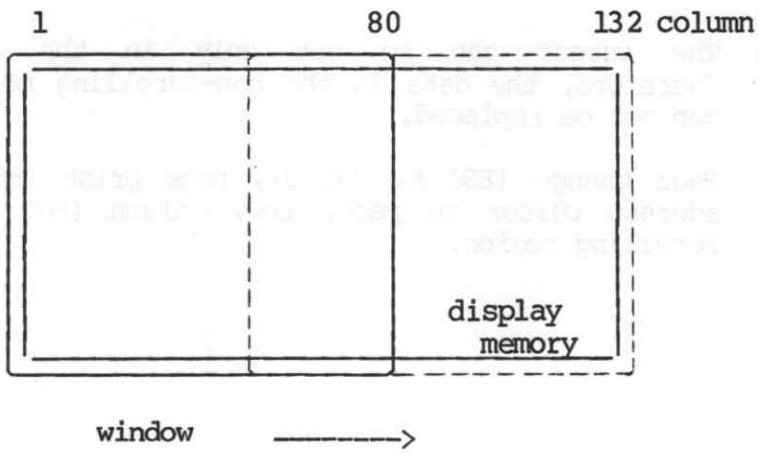
The columns per line feature selects a display memory of either 80 or 132 columns per line. However, the column number displayed on the screen are 80 columns regardless of the 132 columns per line mode. In the 132 columns per line mode, the screen operates as a 80 columns-25 lines widow.



If the 132 columns per line feature is selected, hold down the SHIFT key, and press -> or <- key.
The above window will move right or left by each two columns. But, the cursor will still remain at the same location of the display memory. The following Escape sequence also can move window.

ESC M n

where n = R move window 2 columns right
L move window 2 columns left



When the cursor is at the 80th column, if a character is received from host or entered from the keyboard, the window will move right by 52 columns, and the new received character will be displayed at 80th column relative position and the cursor will be set at 81th column relative position.

On the contrary, when the cursor is at the 132th column, if a character is received on entered, the window will move left by 52 columns, and the cursor will be set at the first column of the next line.

The above horizontal scrolling feature is selected by the following Escape sequences.

ESC ` n

where n = 0 disable horizontal scrolling
1 enable horizontal scrolling

When power on or reconfiguration with set-up mode, the terminal disables horizontal scrolling.

3.27 User Character Generator ROM

The 6402G allows the user to install custom character generators contained in ROM. The following ROM memory chip or equivalent for the character generator must be used.

C.G. ROM ..... Type No. 2764 Fujitsu
memory size 8 k-bytes
Access time 250 ns

The user C.G. ROM is selected by the following Escape sequences.

ESC V 3 n

where n = 0 Select 6402G system fonts
1 Select user defined fonts

You can exchange the system fonts for user-defined fonts for all characters.

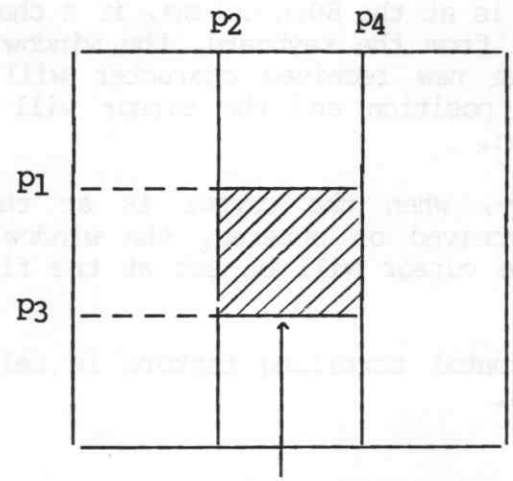
When power on or reconfiguration with set-up mode, the terminal selects system fonts.

3.28 Painting Command

The following Escape sequence allows you to draw pictures:

ESC z 2 p_1 p_2 p_3 p_4

where p_1 = space to DEL of ASCII code for starting row
p_2 = space to o of ASCII code for starting column
p_3 = space to DEL of ASCII code for end row
p_4 = space to o of ASCII code for end row.



Note: 1. In this painting area $(7F)_{16}$ codes are put in graphics mode instead of display character.

2. This painting area is affected by the current video attribute (refer to section 3.3.2 page 30).

3. This command is not effective in Serial field attribute mode.

3.29 Auto Shut-down and Display Control Function

THe 6402G executes automatically display off (Auto shut-down) after a period of no data input to the terminal (approximately after 10 min.). When shut-down, any key depression will re-display the screen. This Auto shut-down function is controlled by a status flag in the configuration table. This flag can be changed by the set-up operation (refer to section 2.5 page 10). By setting this flag off, the Auto shut-down facility becomes disabled. The terminal also features a display control function that turns the screen on or off. This Display control function is controlled by the following Escape sequence.

ESC 9 n

where n = 0 display OFF
1 display ON

3.30 Remote "Set-up" Function

The 6402G has a Remote Set-up capability. This Remote Set-up capability is done easily by the following ESC sequence:

ESC m

When the above escape sequence is received, the terminal stores the configuration values of the current communication page into NVRAM.

3.31 Self Test

The 6402G terminal provides two types of self test: POWER UP SELF TEST, LOCAL SELF TEST (or SELF TEST) to verify proper operation.

The POWER UP SELF TEST is built in the 6402G to test the operation of the terminal each time the power is turned on. The test checks general terminal operation and the memory.

3.31.1 Power Up Self Test

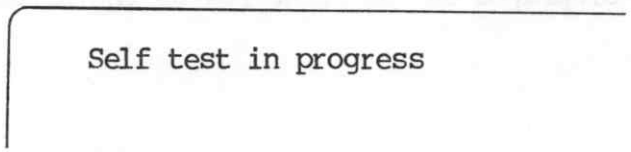
The POWER UP SELF TEST can be started in any one of the following ways:

* Turn the power switch on.

* If power is on, type the following sequence.

  ESC space R

While the POWER SELF TEST is in progress, the following message is displayed on the first row of the screen.



Any error found by the POWER UP SELF TEST is indicated on the screen. (refer to section 2.3.1 page 7)

3.31.2 Self Test

The 6402G provides the following ten test modes.

```
SELF TEST  1 ----- ROM test
SELF TEST  2 ----- RAM test
SELF TEST  3 ----- NVRAM test
SELF TEST  4 ----- Screen display test
SELF TEST  5 ----- Main/printer port test
SELF TEST  6 ----- Mouse port test
SELF TEST  7 ----- Graphics board test
SELF TEST  8 ----- Graphics memory test
SELF TEST  9 ----- All 'E' pattern display
SELF TEST 10 ----- All 'H' pattern display
```

The SELF TEST is carried out through the following procedures.
The depression of ESC c sets the terminal into the SELF TEST mode.
In the SELF TEST mode, the terminal in automatically set into Local mode and the whole screen is cleared.
When the following key is depressed, the corresponding SELF TEST is executed.

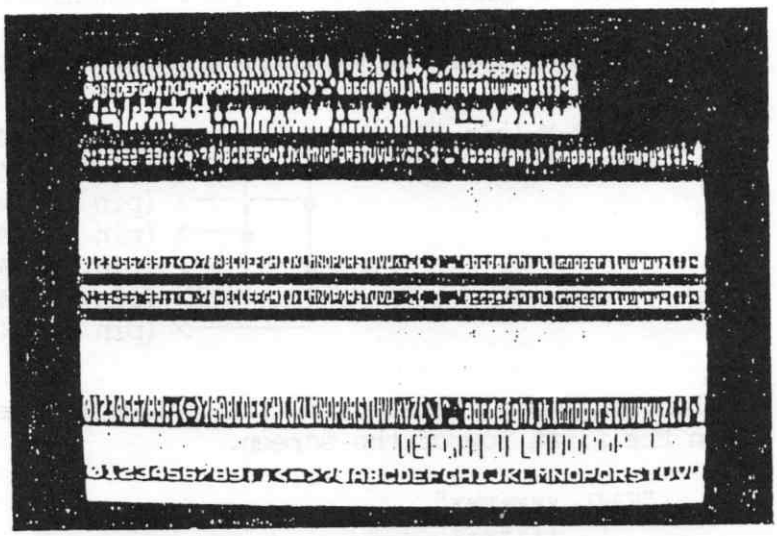
Keys to be depressed	
1	SELF TEST 1 (ROM test)
2	SELF TEST 2 (RAM test)
3	SELF TEST 3 (NVRAM test)
4	SELF TEST 4 (Screen display test)
5	SELF TEST 5 (Main/printer port test)
6	SELF TEST 6 (Mouse port test)
7	SELF TEST 7 (Graphics board test)
8	SELF TEST 8 (Graphics memory test)
9	SELF TEST 9 (All 'E' pattern display)
:	SELF TEST 10 (All 'H' pattern display)
0	Exit of SELF-TEST mode (Return to Power on state)

a. SELF TEST 1 (ROM Test)
SELF TEST 1 checks the entire program ROM. When a ROM error is detected, the message "ER01" is displayed on the Status Line. When the test ends with no error detedtion, the message "PASS" is displayed on the first row of the screen.

b. SELF TEST 2 (RAM Test)
SELF TEST 2 checks the system RAM and the display RAM except graphics display memory.
When a RAM error is detected the message "ER02" is displayed on the Status Line.
When the test ends with no error detection, the message "PASS" is displayed on the first row of the screen.

c. SELF TEST 3 (NVRAM Test)
SELF TEST 3 checks the non-volatile RAM memory backed up by the battery.
When an error is detected, the message "ER03" is displayed on the Status Line.
When the test ends with no error detection, the message "PASS" is displayed on the first row of the screen.

d. SELF TEST 4 (Screen Display Test)
SELF TEST 4 checks the video attributes and the display of all character set.



e. SELF TEST 5 (Main & Printer Port Test)
SELF TEST 5 checks the main and printer port's communications by running four pattern test.

TEST 1 $(55)_{16}$ Pattern from Main port to Printer port
TEST 2 $(AA)_{16}$ Pattern from Main port to Printer port
TEST 3 $(55)_{16}$ Pattern from Printer port to Main port
TEST 4 $(2A)_{16}$ Pattern from Printer port to Main port

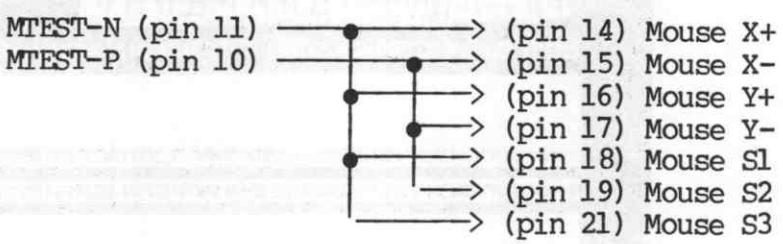
Before the execution of this test, the following preparation shall be done.

i. Connect pin 2 of Main port to pin 2 of Printer port.
ii. Connect pin 3 of Main port to pin 3 of Printer port.
iii. Set both ports to the same transmission rate.

When an error is detected, the following message is displayed on the first line of screen.

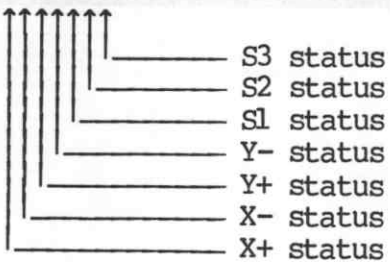
"FAIL x" where x indicates the test number

f. SELF TEST 6 (Mouse Port Test)
SELF TEST 6 checks the mouse port communication by the pattern '1' and '0'.
To run this test, the mouse port shall be connected as follows:



When an error is detected, the following message is displayed on the first row of the screen.

"FAIL xxxxxxx"



where x = 1 indicates PASS,
= 0 indicates FAIL.

When the test ends with no error detection, the message "PASS" is displayed.

g. SELF TEST 7 (Graphics Board Test)
SELF TEST 7 checks the graphics command operation and the grey scale patterns.

h. SELF TEST 8 (Graphics Display Memory Test)
SELF TEST 8 checks the graphics display memory. When a memory error is detected, the message "ER04" is displayed on the Status Line. When the test ends with no error detection, the message "PASS" is displayed on the first row of the screen.

i. SELF TEST 9 (All "E" Pattern Display)
"E" characters are displayed on the whole screen.

j. SELF TEST 10 (All "H" Pattern Display)
"H" characters are displayed on the whole screen.

3.32 Buzzer Behavior

The buzzer sounds for about 0.5 seconds in any of the following events:

(1) When a BEL code has been received or entered from the keyboard.

(2) When the terminal is first turned on.

(3) When the **BREAK** key has been pressed; and when pressed at the same time as **SHIFT**.

3.33 Disabling/Enabling the Keyboard

You can disable (lock) all keys except **FUNCT, BREAK, SETUP, NOSCL, LOC ESC, CAPS LOCK** and **F1** to **F11.**
To disable the keyboard, use the following ESC sequence.

ESC £

The keyboard will remain disabled until one of the following occures:

The terminal receives an ESC "

You press **SHIFT BREAK.**

3.34 Mouse Action in Character Mode

The mouse is active in both character mode and graphics mode (refer to section 4.23 page 115).
In character mode, the mouse is controlled by the following ESC sequences.

(1) ESC V 5 0 : Disable mouse
The mouse operation will be ignored in character mode. When power on or reconfiguration with set-up mode , the terminal disables the mouse.

(2) ESC V 5 1 : Enable Sample mode
Cursor key codes corresponded to the mouse movement are sent to the host except in Local mode. These codes are affected by the edit key programming (refer to section 3.21 page 61) and W.S. mode (refer to secton 3.11 page 45).
When cursor key codes are sent to the host, the terminal will check the following items.

* If no mouse button is depressed, the cursor cannot go away from the screen boundary, and remains within the current screen area.
* If any button is depressed, the cursor can move regardless of the screen boundary, and cursor key codes are sent to the host.

(3) ESC V 5 3 : Enable Request mode
The cursor will follow the mouse movement. Cursor key codes are not sent to the host.
The cursor moves within the screen boundary regardless of the mouse button's status.

When the mouse button is depressed, the terminal send the mouse information and cursor address with same format as ESC V 5 2.

(4) ESC V 5 2 : Send mouse information
The terminal will send the mouse information and cursor address by the following data format.

G_S p1 p2 p3 p4 p5 C_R

where $G_S = (1D)_{16}$ prefix code

p_1 = mouse mode (0 - 7)
bit 0 = 1 : mouse enable
bit 1 = 1 : mouse connected
bit 2 = 0 : Sample mode
1 : Request mode

p_2 = mouse buttons information (0 - 7)
bit 0 = 1 : button 1 depressed
bit 1 = 1 : button 2 depressed
bit 2 = 1 : button 3 depressed

p_3 = cursor row ($(20)_{16}$ ~ $(7F)_{16}$)

p_4 = cursor column (low) ($(20)_{16}$ ~ $(7F)_{16}$)

p_5 = cursor column (high) ($(20)_{16}$ ~ $(21)_{16}$)
(only 132 column/line)

3.35 Other Mode Controls

During normal operation of the 6402G, several functions may be controlled with code sequences. These functions include Conversation/Block mode change, and exchange Light/Dark background. To change these functions, type their codes in the exact sequence show below.

Light background	ESC b
Dark background	ESC d
Conversation mode on	ESC C
Block mode on	ESC B
Set Half-duplex mode (HDX)	ESC D H
Set Full-duplex mode (FDX)	ESC D F

Table 3.5 Cursor Control and Edit Key Hex Codes
(6402G mode and WordStar mode)

Character	6402G Mode			WordStar Mode		
	Un-shifted	Shifted	Control	Un-shifted	Shifted	Control
BACK SPACE	08	08	08	13	13	13
TAB	09	09	09	09	09	09
BACK TAB	1B49	1B49	1B49	01	01	01
PRINT	1B50	1B4C	1B4C	10	10	10
HOME	1E	1E	1E	00	00	00
↓	16	0A	0A	18	03	03
↑	0B	1B6A	1B6A	05	12	12
←	08	1B4D4C	1B4D4C	13	01	01
→	0C	1B4D52	1B4D52	04	06	06
LINE INS	1B45	1B4E	1B4E	0E	0E	0E
LINE DEL	1B52	1B4F	1B4F	19	19	19
CHAR INS	1B51	1B71	1B71	16	16	16
CHAR DEL	1B57	1B72	1B72	07	07	07
LINE ERASE	1B54	1B74	1B74	00	00	00
PAGE ERASE	1B59	1B79	1B79	00	00	00
SEND	1B37	1B36	1B36	00	00	00
CLEAR SPACE	1A	1B2A	1B2A	00	00	00
LINE FEED	0A	0A	0A	00	00	00

Note: In 6402G mode, these key codes are default values.

Table 3.6 Cursor Addressing Codes

Cursor Positioning					
Position X or Y	ASCII Code Transmitted	Position X or Y	ASCII Code Transmitted	Position X or Y	ASCII Code Transmitted
1	Space	33	@	65	`
2	!	34	A	66	a
3	"	35	B	67	b
4	£	36	C	68	c
5	$	37	D	69	d
6	%	38	E	70	e
7	&	39	F	71	f
8	'	40	G	72	g
9	(	41	H	73	h
10	)	42	I	74	i
11	*	43	J	75	j
12	+	44	K	76	k
13	,	45	L	77	l
14	-	46	M	78	m
15	.	47	N	79	n
16	/	48	O	80	o
17	0	49	P	81	p
18	1	50	Q	82	q
19	2	51	R	83	r
20	3	52	S	84	s
21	4	53	T	85	t
22	5	54	U	86	u
23	6	55	V	87	v
24	7	56	W	88	w
25	8	57	X	89	x
26	9	58	Y	90	y
27	:	59	Z	91	z
28	;	60	[	92	{
29	<	61	\	93	¦
30	=	62	]	94	}
31	>	63	^	95	~
32	?	64	_	96	DEL/RUB

Current Page: Transmit ESC = YX (Y = 1 - 96; X = 1 - 80)

Direct Page : Transmit ESC - PYX (P = 0, 1)

Example: ESC - 1%@ positions cursor on Page 1,
Line 6, and Column 33.

Note: ESC-PYX is ignored when P is not zero in Virtual screen mode.
(refer to section 3.5.4 (2) page 37)

Table 3.6 Cursor Addressing Codes
(continued)

Position X or Y	ASCII Code Transmitted	Position X or Y	ASCII Code Transmitted
97	Space !	129	@ !
98	! !	130	A !
99	" !	131	B !
100	£ !	132	C !
101	$!		
102	% !		
103	& !		
104	' !		
105	(!		
106	) !		
107	* !		
108	+ !		
109	, !		
110	- !		
111	. !		
112	/ !		
113	0 !		
114	1 !		
115	2 !		
116	3 !		
117	4 !		
118	5 !		
119	6 !		
120	7 !		
121	8 !		
122	9 !		
123	: !		
124	; !		
125	< !		
126	= !		
127	> !		
128	? !		

Example:

Current page: Transmit ESC = YX

ESC = V 9 !

Line 55, column 122

Table 3.7 UK ASCII Chart

b4	b3	b2	b1	ROW \ COLUMN	b7 b6 b5 = 0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
					0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	£	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	Note 1	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	¦
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	Note 2	.	>	N	^	n	~
1	1	1	1	15	SI	Note 3	/	?	O	_	o	Note 4

Note 1: SKIP/HT

Note 2: HOME/RS

Note 3: NEW LINE/US

Note 4: DEL/RUB

Table 3.8 Alphanumeric Key Hex Codes

Character	Unshifted	CAPS LOCK	Shifted	CTRL
A	61	41	41	01
B	62	42	42	02
C	63	43	43	03
D	64	44	44	04
E	65	45	45	05
F	66	46	46	06
G	67	47	47	07
H	68	48	48	08
I	69	49	49	09
J	6A	4A	4A	0A
K	6B	4B	4B	0B
L	6C	4C	4C	0C
M	6D	4D	4D	0D
N	6E	4E	4E	0E
0	6F	4F	4F	0F
P	70	50	50	10
Q	71	51	51	11
R	72	52	52	12
S	73	53	53	13
T	74	54	54	14
U	75	55	55	15
V	76	56	56	16
W	77	57	57	17
X	78	58	58	18
Y	79	59	59	19
Z	7A	5A	5A	1A

Table 3.8 Alphanumeric Key Hex Codes
(continued)

Character	Unshifted	CAPS LOCK	Shifted	CTRL
1 !	31	31	21	00
2 @	32	32	40	00
3 £	33	33	23	00
4 $	34	34	24	00
5 %	35	35	25	00
6 ^	36	36	5E	1E
7 &	37	37	26	00
8 *	38	38	2A	00
9 (	39	39	28	00
0)	30	30	29	00
- _	2D	2D	5F	1F
= +	3D	3D	2B	00
\ |	5C	5C	7C	1C
{ }	7B	7B	7D	00
[ ]	5B	5B	5D	1D
; :	3B	3B	3A	00
' "	27	27	22	00
, <	2C	2C	3C	00
. >	2E	2E	3E	00
/ ?	2F	2F	3F	00
` ~	60	60	7E	00
9	39	39	39	39
8	38	38	38	38
7	37	37	37	37
6	36	36	36	36
5	35	35	35	35
4	34	34	34	34
3	33	33	33	33
2	32	32	32	32
1	31	31	31	31
0	30	30	30	30
-	2D	2D	2D	2D
SPACE BAR	20	20	20	20
LINE FEED	0A	0A	0A	0A
RETURN	0D	0D	0D	0D
ENTER	0D	0D	0D	0D
DEL	7F	7F	7F	7F
ESC	1B	1B	LOCAL	LOCAL

Note: The alphanumeric keys operate in Block, Local, Half-duplex and Full-duplex modes.

Table 3.9 Function Key Default Hex Codes

Key	Unshifted	Shifted
F1	01 40 0D	01 60 0D
F2	01 41 0D	01 61 0D
F3	01 42 0D	01 62 0D
F4	01 43 0D	01 63 0D
F5	01 44 0D	01 64 0D
F6	01 45 0D	01 65 0D
F7	01 46 0D	01 66 0D
F8	01 47 0D	01 67 0D
F9	01 48 0D	01 68 0D
F10	01 49 0D	01 69 0D
F11	01 4A 0D	01 6A 0D

Note: Until you reprogram a function key, its default values are as listed in Table 3.9.

Table 3.10 Local Only Keys

Key	Function
SETUP/NOSCL	Enables and disables screen update (toggle action)
SHIFT SETUP/NOSCL	Provides entry to and exit from set-up mode.
SHIFT LOCESC/ESC	Provides entry to Local Escape sequence (local action only).
CTRL BREAK	Executes power-up sequence.
SHIFT BREAK	Terminal reset (partial reset only - refer to section 3.2.6 page 29).
BREAK	Causes about 250 msec space to be sent to the host.

Note: The **BREAK** key, when pressed unshifted, performs a unique function. As such, it operates neither locally nor in duplex. The key is listed in this table arbitrarily for the sake of categorization.

Table 3.11 Key Action Modifiers

Key	Function
CRTL	When pressed with alpha numeric keys, generates a control character.
SHIFT	When pressed with another key, it generates an upper case or legend character.
CAPS LOCK	When down, it causes all letter keys to generate upper case characters.
FUNCT	When pressed with alpha-numeric keys, it causes a 3 characters sequence to be transmitted to the host: the first and third characters are always SOH and CR ($(01)_{16}$ and $(0D)_{16}$). The second character is a normal, shifted, or CTRL modified alpha-numeric character.

4. GRAPHICS OPTION

The optional graphics board is mounted inside the cabinet of the 6402G Video Display Terminal and adds to the terminal the ability to display full graphical as points on a 640 x 400 matrix.
This chapter contains basic information about various command sets for the full graphics terminal.

4.1 Operating Modes

6402G has two major operating modes:

Basic Mode (or character display mode)

In this mode, all data entering the Graphics Board is passed on to the Main Control Board, and all control codes and sequences (except those which cause mode changes) are also passed on.

Full Graphics Mode

In this mode, all data entering the Graphics Board is treated as a graphics command sequence, stream of (X, Y) coordinates on data to be drawn.

These above modes are selected by the following ESC sequences.

ESC H 1	Enter into Full Graphics mode
ESC H 0	Return to Basic Character mode

4.2 Graphics Screen

The graphics screen is a rectangular array of points, 640 x 400 addressable points.
A coordinate is a number that specifies a position.
X-coordinates specify horizontal positions and Y-coordinates specify vertical positions.

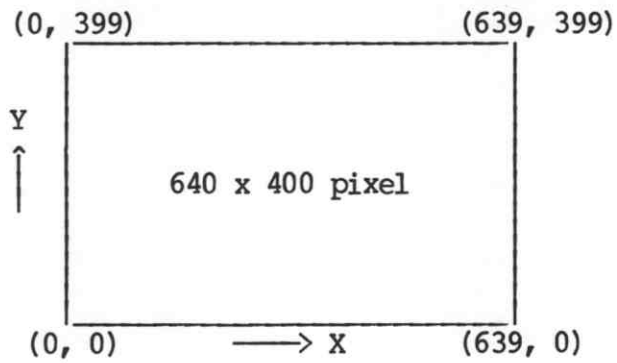


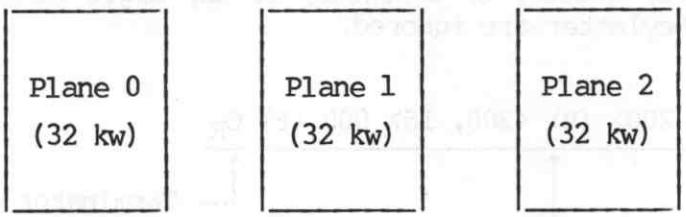
Fig. 4.1.1 Screen Resolution

The graphics memory includes three planes, and the following eight level intensities are created by combining these three planes.

Plane 2	Plane 1	Plane 0	Attributes Grey scale
0	0	0	Dark
0	0	1	1/7 bright
0	1	0	2/7 bright
0	1	1	3/7 bright
1	0	0	4/7 bright
1	0	1	5/7 bright
1	1	0	6/7 bright
1	1	1	Full bright

0: Not drawn

1: Drawn



Where: lw = 8 bits

Note: Do not give commands such as Circle, Pie, Bar, Cursor Position etc that exceed the area of the screen, as this may result in spurious arcs or lines being drawn.

Fig. 4.2.1 Graphics Memory

4.3 Graphics Cursor

The graphics cursor takes the form of a cross 15 x 15 pixels in size. The center of the cross represents the current position on the screen. The current position is the one which your next drawing or action command will act.
When Graphics mode is first entered the cursor is invisible, so if you wish to see it, issue the following command:

S (Cl) C_R (refer to section 4.20.2 page 112)

The cursor may be moved around the screen using the cursor movement key (↑ , ↓ , ->, <-), except when they are pressed between a command keyletter and a parameter, within parameters, and between parameters of a B or G command. The cursor coordinates may be transmitted to the host computer system using a Report command.

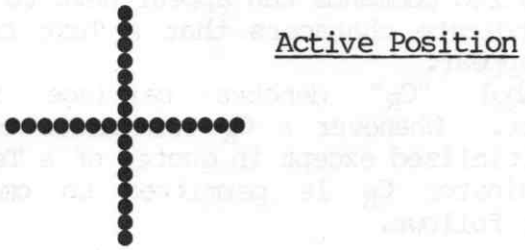
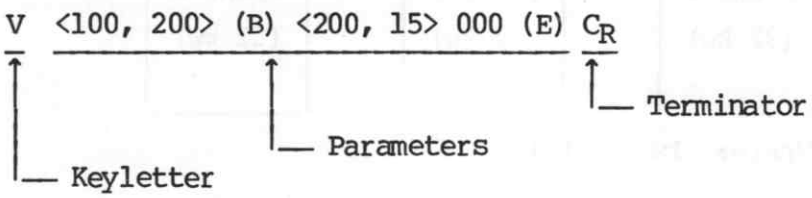


Fig 4.3.1 Graphics Cursor

4.4 Graphics Command Syntax

Single Character Command Syntax

Each command consists of three parts: the command key character, the command parameters, and the command terminator.
Any commands from the complete graphics instruction sets can follow the initial selection characters.
A graphics command is a single alphabetic command key character followed by parameters in many formats including parentheses and brackets.
Only upper-case alphabetic characters are accepted as a command key and command parameters. The key character is usually the first letter of the name of the command, for example "T" for Text.
Any keyletter that is not included in this guide, and any character in parentheses, quotes, or brackets, or any digit strings, that follow the invalid keyletter are ignored.



Note: In an explanation of a command in this section, you need not to enter a space between parameters, or between a keyletter and a parameter; the space is for clarity only.

When items are enclosed in parenthesis characters "(" and ")" or angle brackets in format statements, these punctuation marks must be included in the command, if the items they enclose are specified. Items enclosed in parenthesis are parameters.

Example:

T(Sn) = Text character cell size

The numbers in angle brackets are position information called coordinate or point specifiers.
In the case where a keyletter has one or more numbers after it with no parentheses, angle brackets, or quotes, the numbers are pixel vectors. These are position information that specifies movement in one of eight possible directions.
Parenthesized commands can appear next to each other.
Quotes indicate characers that a Text command can put on the screen as they appear.
The symbol "C_R" denotes carriage return, and shows command terminator. Whenever a C_R terminator code is received, the command is re-initialized except in quotes of a Text command.
The terminator C_R is permitted to omit in the case where next keyletter follows.

4.5 Graphics Command List

6402G Graphics Option provides the following commands for business graphics that can be used by the majority of applications.

Table 4.5.1 Graphics Command List

No.	Command Keyletter	Command Name	Function
1.	P	Position	Places current cursor at designated position.
2.	O	Plot	Dots at current cursor position.
3.	V	Vector	Draws vectors.
4.	B	Bar	Draws quadrangle.
5.	C	Circle	Draws circle.
6.	A	Arc	Draws arc.
7.	I	Pie Chart	Draws pie chart.
8.	T	Text	Draws character strings.
9.	M	Polymarker	Draws various graphics markers.
10.	G	Polygon	Draws polygon.
11.	F	Fill	Fills area by chading pattern
12.	W	Write Control	Designates various drawing conditions.
13.	S	Screen Control	Clear graphics memory.
14.	@	Macrograph	Defines macrograph string.
15.	R	Report	Reports current cursor address to host.
16.	Z	Device Control	Control aux. devices

4.6 Position Command

The Position command sets or changes the current position and moves the graphics cursor to the new current position. The current position can be defined by absolute and relative numbers and also these numbers can be combined in one command.

4.6.1 Positioning

The numbers in angle brackets "<" and ">" are position information called coordinate or point specifiers.
The first number is the X-axis or horizontal position, and the second number is the Y-axis or vertical position. A comma separates the two numbers.

(1) Position
Format: P <position> C_R

a. Absolute Position
This command moves the current position to the given coordinates refered to the origin.
When the numbers in angle brackets do not have + or - signs with them, the position given is absolute (refered to the origin).

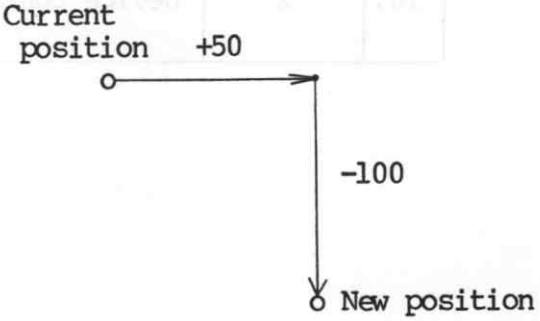
P <100> or P <100,>
When only one number is in angle brackets, without a comma or with a comma after it, it is a new X position while the Y position stays the same.

P <,200> C_R
When only one number is in angle brackets, with a comma in front of it, it is a new Y position while the X position stays the same.

P <100, 200> C_R
This command moves to the position given by X, Y absolute coordinates.

b. Relative Position
This command moves the current position by adding the given numbers to the last current position.
If a coordinate has sign, it is a relative coordinate. If a X or Y coordinate is not given, its value is unchanged.

Sample: P <+50, -100> C_R



c. Combining absolute and relative positions
Absolute and relative values can be combined in one command. Sign the coordinate that is relative and leave the absolute coordinate unsigned.

P < > C_R
The < > argument is a relative position specification indicating no change in X or Y.

4.6.2 Pixel Vector

Format: P Pv C_R

This command moves the current position in the direction specified by 'Pv' (also called 'Pixel Vector').
A Pixel Vector is a vector whose length is the distance between two pixels multiplied by a Pixel Multiplier that is set with a Write control command.
A Pixel Vector has a limited set of directions at 45 degree intervals starting at 0 on a circle. They are specified by the integers 0 through 7 according to Fig. 4.6.1.

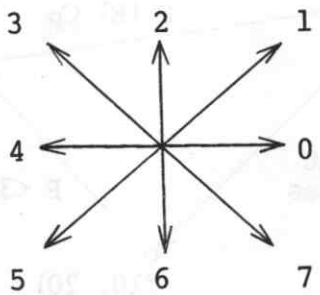
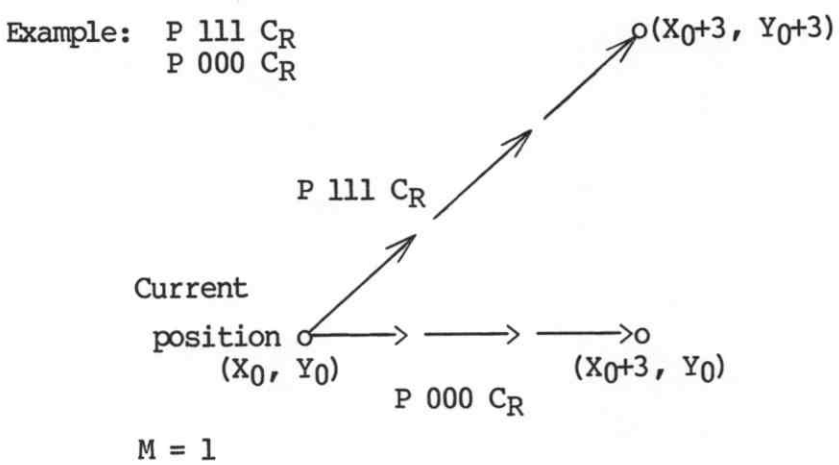


Fig. 4.6.1 Pixel Vector



4.6.3 Saving Current Position

Format: P (B) C_R

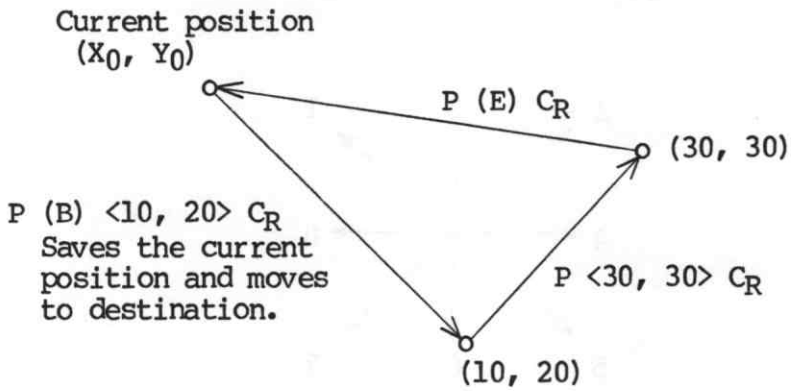
This command saves the first position to allow to return to the beginning position without respecifying that position. The saved position is restored by the (E) command.
The maximum ten points can be saved into the push-pop stack memory.

4.6.4 Restoring Previous Position

Format: P (E) C_R

This command restores the latest position saved by the P (B) command.
(B) and (E) command options are used to group sets of coordinates together in blocks, so they can be processed as units, for example, for polygon definition or filling or shading operations.

Example: P (B) <10, 20> <30, 30> (E) C_R

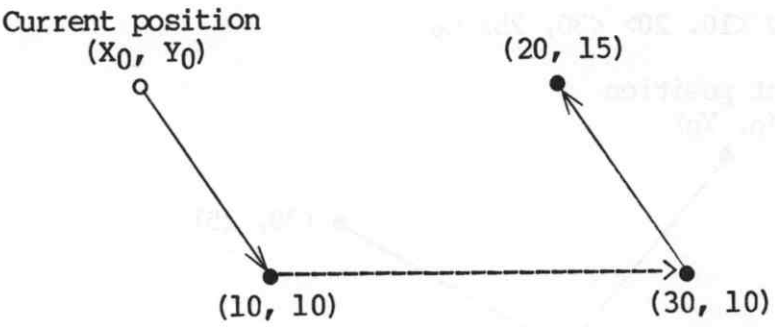


4.7 Plot Command

4.7.1 Drawing dots

Format: O <P_1> <P_2> ... <P_n> C_R

This command draws a dot (one pixel) at the position specified with <P_1> to <P_n> parameters.
A pixel is the smallest unit of the intensity information on the screen. The intersection of every horizontal address and every vertical address is a pixel.
It is useful because most other vector commands do not draw the pixel at the current positions. The drawing current position moves to the <P_n> position.



Example: O <10, 10> <+20> <-10, +5> C_R

4.7.2 Saving Current Position

Format: O (B) C_R

This command saves the current position to allow to return to the previous position.
This command uses the same stack memory as the P (B) command.

4.7.3 Restoring Previous Position

Format: O (E) C_R

This command restores the current position as it was stored in the push-pop stack memory by the previous (B) command.

4.8 Vector Command

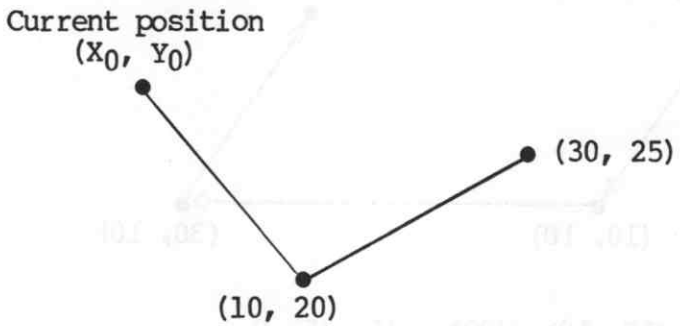
The Vector command draws a straight line between the current cursor position and a specified screen location.

4.8.1 Drawing a Straight Line

Format: V <P_1> <P_2> ... <P_n> C_R

This command draws a straight line from the current position to the position given.
Any number of positions can be included in the same Vector command to draw a continuous series of straight lines.

Example: V <10, 20> <30, 25> C_R

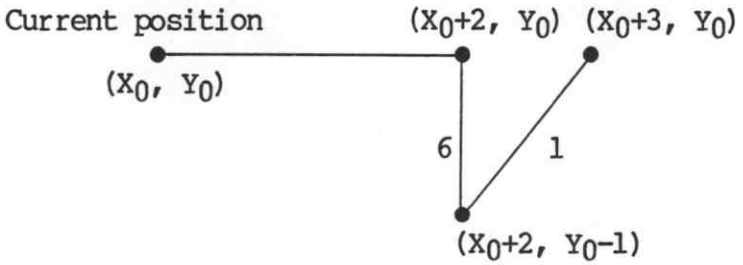


4.8.2 Pixel Vector

Format: V Pv C_R

This command draws a line one pixel multiplier long in the direction specified by 'Pv'.
The direction may be any of the integers 0 through 7 according to Fig. 4.6.1.
The direction numbers represent angles at 45 degree intervals from 0 (0) to 315 (7).
Each time a pixel vector number appears after the command key letter, the line is drawn one by one pixel multiplier in that direction. See Pixel Multiplier in the Writing Controls section.

Example: V 0061 C_R



4.8.3 Saving Current Position

Format: V (B) C_R

This command saves the current position to allow to return to the previous position. This command uses the same stack memory as the P (B) command.

4.8.4 Restoring Previous Position

Format: V (E) C_R

This command restores the current position as it was stored in the push-pop stack memory by the previous (B) command.

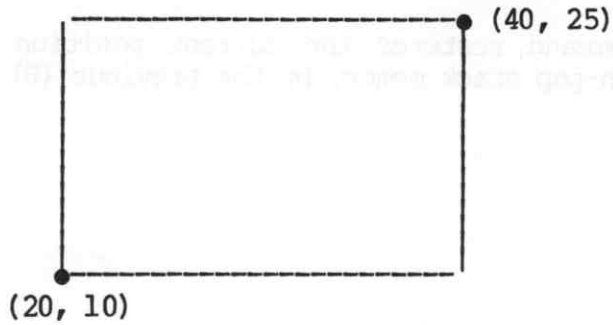
4.9 Bar Command

This command draws the quadrangle specified by two diagonal positions. This command is affected by a Write Control command.

Format: B <position> <position> C_R

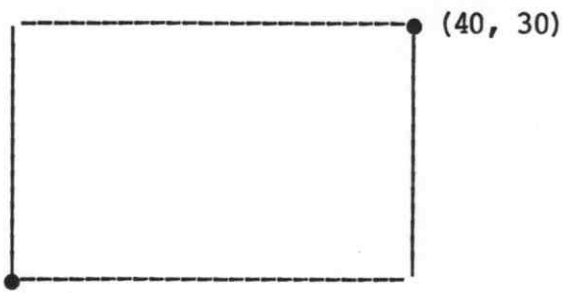
The current position is set to the starting point after the drawing is completed.

Example: B <20, 10> <40, 25> C_R



If no number is in angle brackets, it shows the current position. So, if only one position is specified, the other diagonal position is defined as the current position.

Example: B <40, 30> C_R



This command cannot accept more than 3 <position>s.
Only the first 2 <position>s are interpretted as a position specifier to draw a quadrangle and after drawing, this command is canceled.

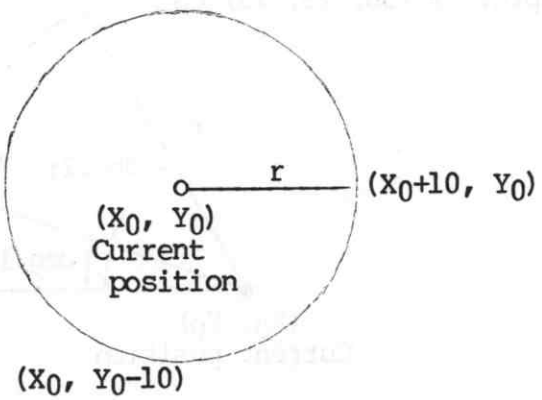
4.10 Circle Command

Circle with center at current position

Format: C (r) C_R

This command draws a circle around the current position with solid line circumference. The radius (r) of the circle is the distance from the current position at the center to the circumference. This command cannot accept continuous (r) parameters. For example, C (r1) (r2) C_R is not acceptable but C (r1) C_R C (r2) C_R is acceptable. The current position stays at the center after the circle is drawn. This command is affected by a Write Control command except a line type.

Example: C (10) C_R



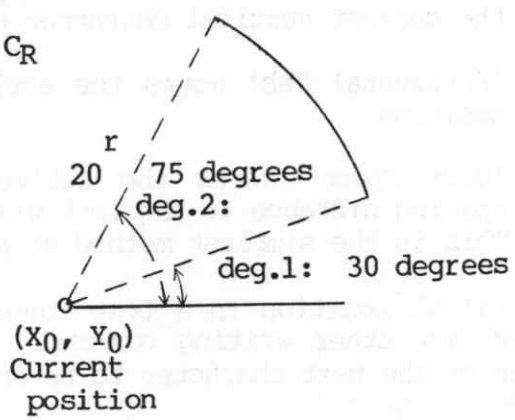
4.11 Arc Command

Arc is a part of a circle. It is specified by the current position as the center of the circle, the radius of the circle: r the starting angle of the circle: deg.1 and the end of the angle: deg.2 to be drawn measured in degree.

Format: A (r, deg.1, deg.2) C_R

The radius of the circle that the arc is a part of is the length between the current position and the circumference.
The arc is drawn counterclockwise by the specified degrees.
The current position is put on the last position where the arc is drawn counterclockwise by the specified degree 2.
This command also cannot accept continuous (r, deg.1, deg.2) parameters as the C command.

Example: A (20, 30, 75) C_R



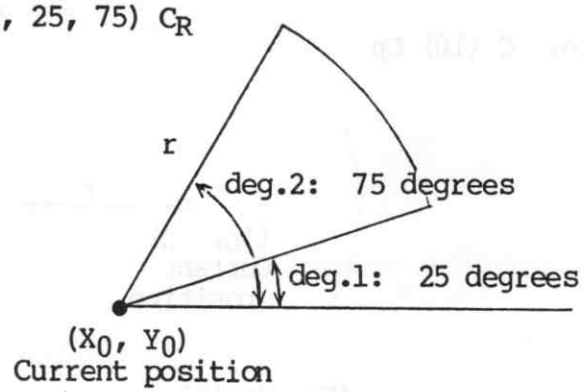
4.12 Pie Command

This command draws a pie chart that is specified by the current position as the center of the circle, the radius of the circle: r, and the starting angle: deg.1 and the end angle: deg.2.

Format: I (r, deg.1, deg.2) C_R

The arc is drawn counterclockwise by the specified degrees. The current position stays at the center after the pie chart is drawn.
This command is affected by a W command.
This command also cannot accept continuous (r, deg.1, deg.2) parameters as the C command.

Example: I (30, 25, 75) C_R



4.13 Text Command

The graphics processor displays characters differently from the character display mode.
The Text command can draw characters with many combinations of size, orientation, and position. The Text command is formatted as a keyletter followed by options and quoted string.
All options in the T command apply to all following T commands until they are changed in another Text command.
There is no upper limitation on the length of a quoted string. All contol characters except CR, LF, HT, BS are ignored.

CR: 'Carriage return' moves the active position to the position it had when the current quoted string began to be drawn.

LF: 'Line Feed' moves the active position down a distance equal to the current vertical character cell size.

HT: 'Horizontal Tab' moves the active position forward one character position.

BS: 'Back Space' moves the active position back one current text spacing distance to the last written character position.
This is the simplest method of performing an overstrike.

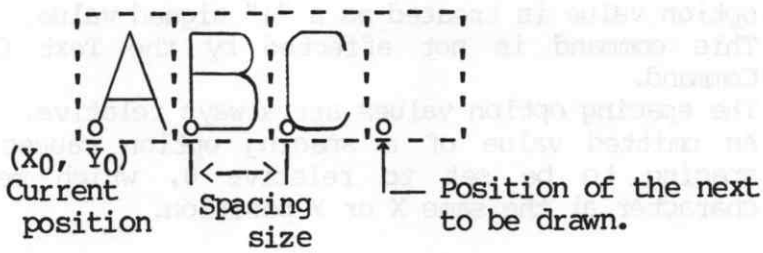
The initial position in a text command is the current position at the end of any other writing command. This position is the bottom left corner of the next character to be drawn.

4.13.1 Text

Format: T 'text' C_R or T "text" C_R

This is the basic form of the text command. After drawing one character, the current position is advanced by a spacing size.

Example: T 'ABC' C_R



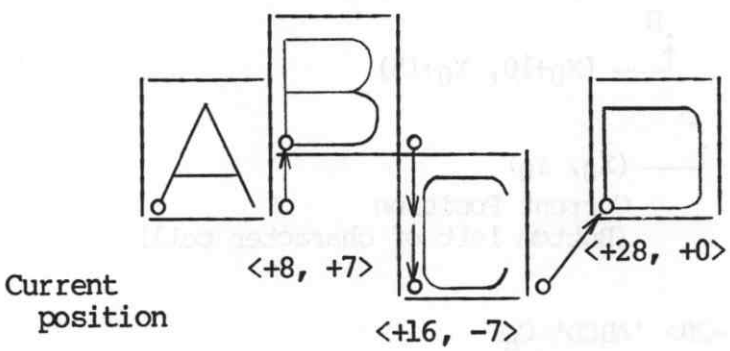
A standard character cell is 8 units wide by 14 units high.

4.13.2 Text Pixel Vector String

Format: T Pv 'Text' C_R

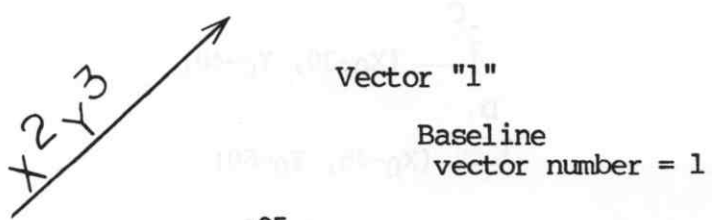
This command uses pixel vector numbers to indicate directions of offset for characters. This command of offset is determined by the size of the characters which is affected by a Text Character Cell Size command, and it is one half of the character size given in the direction of movement.
A character spacing does not apply.

Example: T 'A' 2 'B' 66 'C' 1 'D' C_R



The vector direction is relative to the character baseline. Therefore, this command is affected by a Tilt Direction command. The pixel vector numbers can appear anywhere in a command except in quotes.

Example: T 'X' 2 '2' 6 'Y' 2 '3' C_R



4.13.3 Text Character Spacing

Format: T <position> 'Text' C_R

The spacing option follows the T command keyletter before any parenthesized options.
It must be a relative position specifier that indicates the distance and direction that the active position must be more from the bottom left corner of the next character. A unsigned spacing option value is treated as a "+" signed value.
This command is not affected by the Text Character Cell Size Command.
The spacing option values are always relative.
An omitted value of a spacing option causes that dimension of spacing to be set to relative 0, which means draw the next character at the same X or Y position.

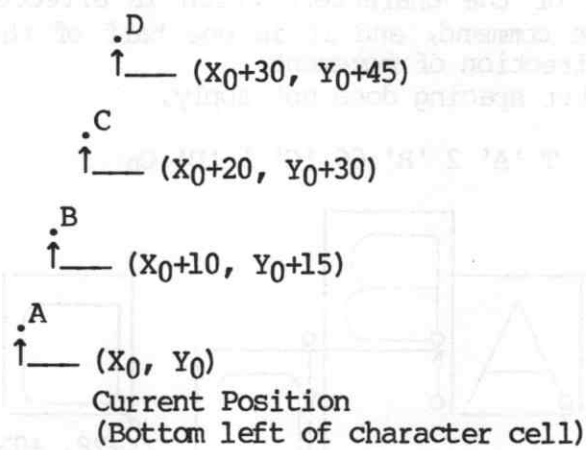
T <+10> 'ABCD' C_R

ABCD

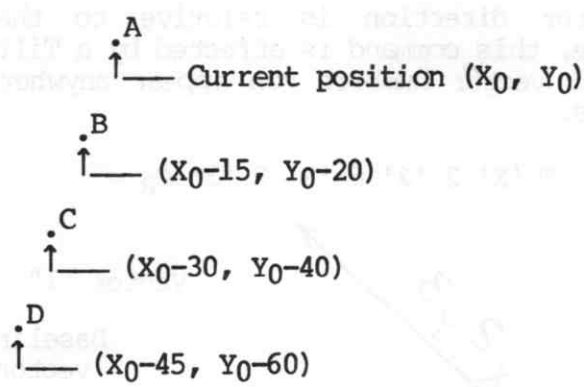
T <-10> 'ABCD' C_R

DCBA

T <+10, +15> 'ABCD' C_R



T <-15, -20> 'ABCD' C_R



4.13.4 Text Character Cell Size

Format: T (Sn) C_R

Where n = cell size multiplier, 0 through 15 integer

This command defines the size of the area on screen that is drawn by a single text character of the T command.
The maximum area specifiers is 16 times of the standard character cell size.
The standard character cell size is width of 8 and height of 14 pixels.
This command does not multiply the character spacing. Therefore, when a character cell size is changed, the character spacing factor must be rearranged at the same time.

Example: T (S0) 'AB' C_R

AB

Example: T <+18> (S1) 'AB' C_R

AB

Cell size n = 1 (16 x 28 pixels)
character spacing = <+18>

4.13.5 Text String and Character Tilt Direction

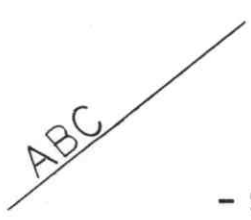
Format: T (Dd) C_R

This command defines the tilt of the baseline for a text string. Individual characters in the string can be tilted at any 45 degree interval on a 360 degree compass.
Text strings to be tilted must be defined with correct baseline direction, character spacing and character cell size.
The D command works only by setting the tilt of characters. Then, the Character Cell Size command is used to provide correct tilted characters size, and character spacing command is used to position the tilted characters on a common correct character spacing.

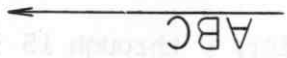
Example: T <+10, +10> (D0) 'ABC' C_R

```
  C
 B
A
```

Example: T (D1) 'ABC' C_R (Spacing: <+10, +10>)



Example: T <-10> (D4) 'ABC' C_R



4.13.6 Text Italic Tilt

Format: T (In) C_R

Where n = 1 ... tilted character
0 ... non-tilted character

The Italies command tilts the vertical lines of individual characters without tilting the horizontal lines. The actual angles of tilt are approximate 45 degrees.
This command can be used with the D command.

Example: T (S2) (I0) 'ABC' C_R

ABC

Example: T (I1) 'ABC' C_R

ABC

Format: T (Nn) C_R

where n = 0 ... complement writing off
1 ... complement writing on

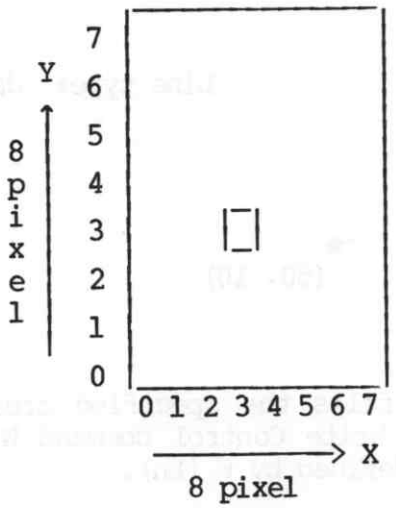
The complement writing character can be used.

4.14 Marker Drawing Command

This command allows you to draw a special graphics character at the specified position.
Each marker is defined by 8 x 8 pixels, and eight types of marker are stored in a marker memory. The Marker Drawing command can draw the marker selected by a number at the specified position.

Format: M <P_1> <P_2> ... <P_n> C_R

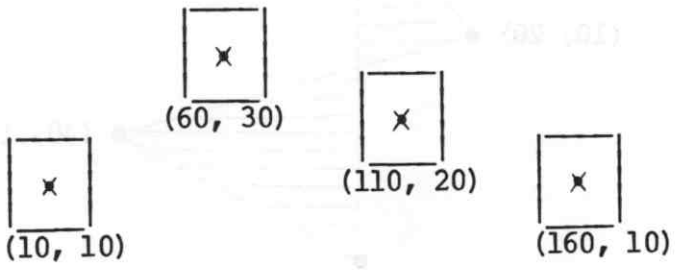
Markers selected by a Write Control command W(P_n) are drawn at the specified position <P_1> <P_2> ... <P_n>.
The Marker command can draw markers with many combinations of size, baseline of character, Italic tilt and negative write which defined by the Text command.
After markers are drawn, the current position moves to the position defined by <P_n>.



The drawing position is defined as a position (3, 3) of 8 x 8 pixels area of the marker.

Fig. 4.14.1

Example: M <10, 10> <+50, +20> <+50, -10> <+50, -10> C_R



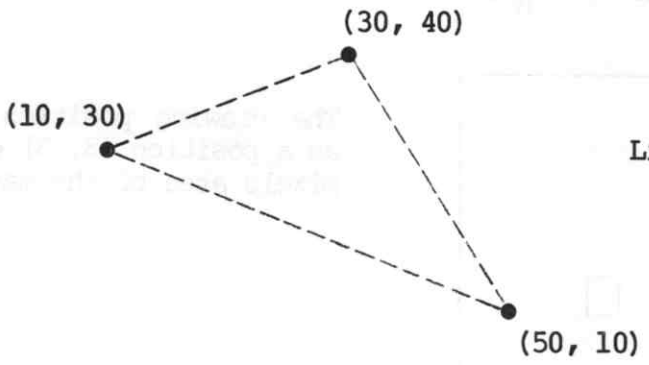
4.15 Polygon Command

4.15.1 Polygon

Format: G <P_1> <P_2> ... <P_n> C_R

This command can draw the polygon specified with <P_1> <P_2> ... <P_n> parameters.
The active drawing cursor position moves to <P_1> position after the last line is drawn.
This command is affected by a Write Control command. When shading off, this command outlines the specified area with the line type defined by the Write Control command W (Ln).

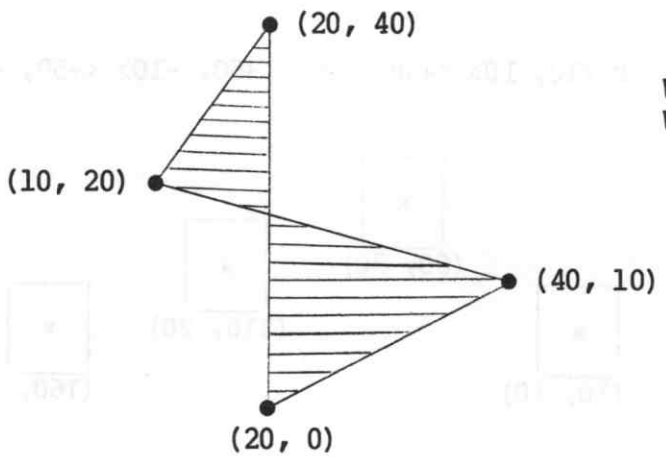
Example: G <10, 30> <50, 10> <30, 40> C_R



Line type: dashed line

When shading on, this command fills the specified area with the shading pattern defined by the Write Control command W (Fn), and outlines it with the line type defined by W (Ln).

Example: G <20, 0> <20, 40> <10, 20> <40, 10> C_R



W (L0)
W (F5)

Note: The maximum number of <p_n> is 96 points. If n is greater than 96, the first 96 points is effective.

4.16 Fill Command

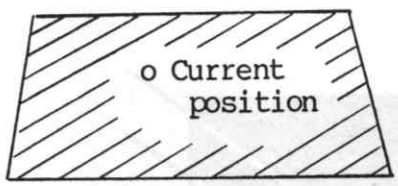
This command fills the inside of a graphics object which includes the current cursor with an intensity. The intensity of the painting can select any one of 8 grey scales which is specified by a W (In) command. But, only one of three planes can be refered as the outline of graphics object.

Format: F (In) C_R

where n: plane number to be refered as a graphics object.

n	Plane No. to be refered
0	Ignored
1	Plane # 0
2	Plane # 1
3	Plane # 0
4	Plane # 2
5	Plane # 2
6	Plane # 1
7	Plane # 0

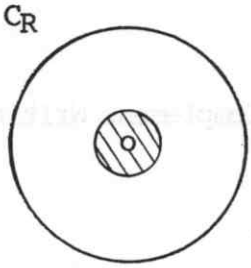
Example: F (I1) C_R



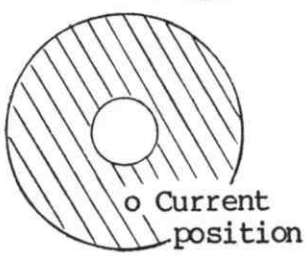
plane 0

The inside of the polygon drawn on plane # 0 is filled with the shading pattern specified by a W (Fn) command and the intensity specified by a W (In) command.

Example: (I2) C_R



Current position



The current position stays at the same position after completion of the Fill command.

Note: If the Fill command is used to an unclosed graphics object, this command does not fill the inside perfectly or does not at all.

4.17 Writing Control Command

This command controls the attributes of intensity and pattern that pixels and shapes can have, and includes the four writing modes, Complement, Erase, Replace and Overlay.
They control the way that pixels are placed in a graphics memory.

W (C) C_R: Enter into Complement Writing mode
W (E) C_R: Enter into Erase Writing mode
W (R) C_R: Enter into Replace Writing mode
W (V) C_R: Enter into Overlay Writing mode
W (In) C_R: Select drawing plane

4.17.1 Complement Writing

Format: W (C) C_R

This command sets the graphics processor in the Complement Writing mode. In this mode, during a write, the bit pattern to be written is complemented to the pixels present in the existing pattern. Complement writing is generally reversible by repeating the same command.

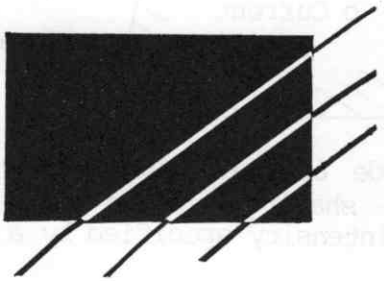


Fig. 4.17.1 Complement Writing

4.17.2 Erase Writing

Format: W (E) C_R

This command sets the graphics processor in the Erase Writing mode. In this mode, during a write, each pixel which is "1" out of the bit pattern to be written erases the current pattern.
Fig. 4.17.2 shows that 3 solid lines have erased a part of shaded box.

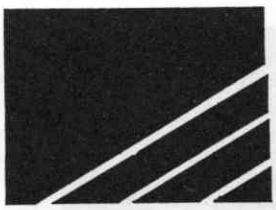


Fig. 4.17.2 Erase Writing

4.17.3 Replace Writing

Format: W (R) C_R

This command sets the graphics processor in the Replace Writing mode to replace the previous pattern with a new bit pattern.
Fig. 4.17.3 shows 3 dashed lines drawn over a shaded box in the Replace Writing mode. A part of shaded box has been replaced with newly drawn 3 dashed lines.

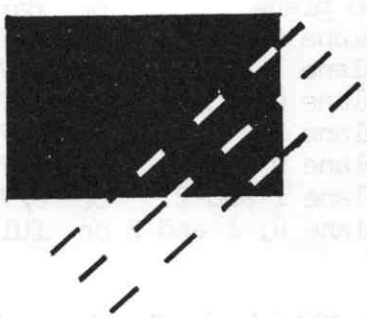


Fig. 4.17.3 Replace Writing

4.17.4 Overlay Writing

Format: W (V) C_R

This command sets the graphics processor in the Overlay Writing mode. In this mode each pixel which is "1" out of the bit pattern to be written is drawn over the current pattern. Therefore any part of the current pattern is not erased.
Fig. 4.17.4 shows 3 dashed lines drawn over shaded box in the Overlay Writing mode.

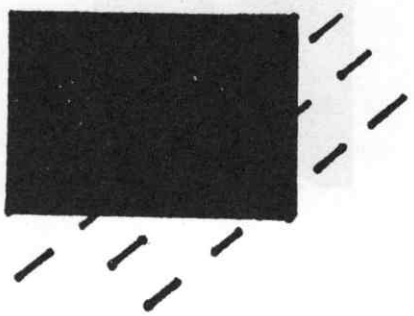


Fig. 4.17.4 Overlay Writing

4.17.5 Select Plane or Grey Scale

Format: W (In) C_R

This command selects planes or grey scale to draw the bit pattern of the foreground specifier: bit "1". Any pixel can have seven choices of appearance. This command gives you control over the individual bits for each pixel in writing command.
In Complement or Erase writing mode, this command selects planes to draw. In Replace or Overlay writing mode, this command selects the grey scale to draw.

n = 0:	no plane	or	dark
1:	plane 0	or	1/7 bright
2:	plane 1	or	2/7 bright
3:	plane 0 and 1	or	3/7 bright
4:	plane 2	or	4/7 bright
5:	plane 0 and 2	or	5/7 bright
6:	plane 1 and 2	or	6/7 bright
7:	plane 0, 1 and 2	or	full bright

Each of the 640 x 400 pixels has three bits in the display memory. The three bits held an address that selects one of eight monochrome intensities can display at one time.
The Select Plane command lets you write each of the bits individually by limiting the write commands to one plane or the others.

4.17.6 Line Type

Format: W (Ln) C_R

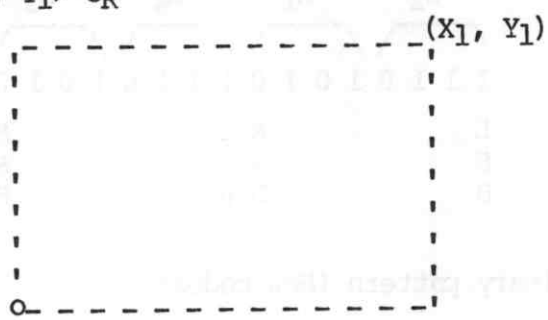
where n = line type number

This command selects the line type that is used by the Vector, Polygon, and Bar commands.
The Line Type command allows you to vary the appearance of lines in a graphic object. When the terminal is powered on, many of the writing control commands have default values assigned.
The Line Type command has the following default line type values.

line type number		
0	————————	solid
1	— — — — — — — —	dashed
2	- - - - - - - - - - - -	dotted
3	- ——— - ——— - ——— - ———	dashed-dotted
4	——— - - ——— - - ——— - -	dashed-dotted dotted
5	——— ——— ——— ——— ———	long dashed
6	——— - ——— - ——— - ———	long dashed dotted
7		undefined (all null)

Example: W (L2) C_R

B $\langle X_1, Y_1 \rangle$ C_R



The Writing Control commands have several patterns to vary the appearance of lines and shaded areas in a graphic object.
Patterns are stored in a memory which is read during a write operation to control the appearance of pixels in graphic objects.
For example, a Vector command may write a series of pixels in a line on the display. As the pixels are written, the pattern memory is read bit by bit to determine whether a corresponding pixel should have the foreground or background intensity.

4.17.7 Specify Line Type

This command specifys a pattern of line type for the Select Line Type command.

Format: W (L n, hhhh) C_R

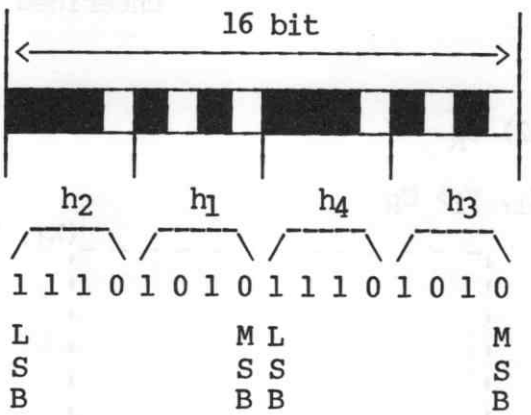
where n = line type number
hhhh = line pattern described with four hexa-decimal codes. (2 Hexa-decimal pairs)

Each line type can be specified by a sixteen-bits binary pattern that you can set with '1' and '0'. When the graphics processor draws on the screen, bits that are set to "1" are drawn, and bits that are set to "0" appear as gaps in the line.
If more than 4 hexa-decimal codes are received, the first 4 codes are acceptable and the others are ignored. And if less than 4 hexa-decimal codes, "0" $(30)_{16}$ is assigned to the remainder of 4 hexa-decimal codes.

Example:

Line type: dashed-dotted dotted

displayed line



binary pattern (Hex codes)

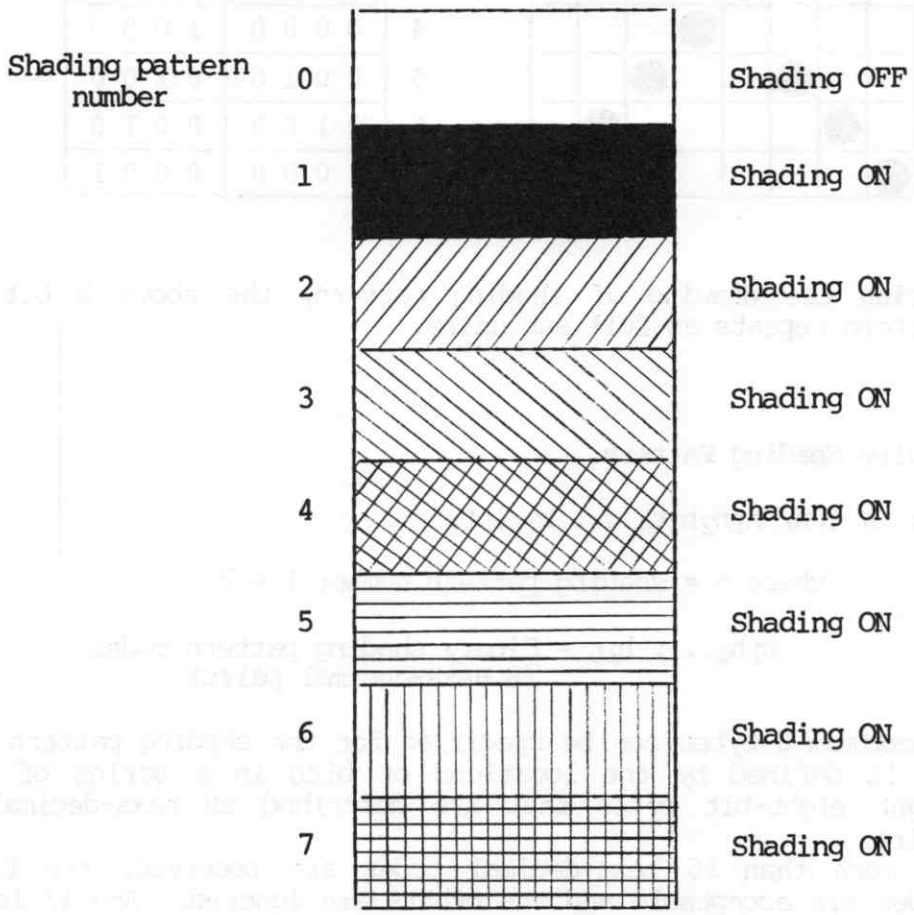
$h_1h_2h_3h_4$ = 5757

W (L 2, 5757) C_R

4.17.8 Select Shading Pattern

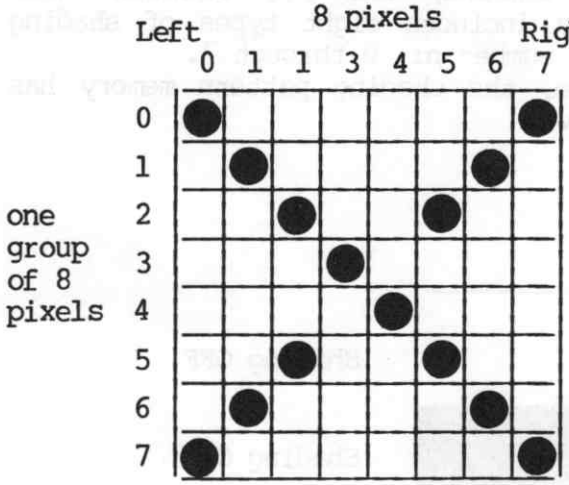
Format: W (Fn) C_R

Shading lets you fill the inside of a graphic object to describe the outline of the graphic object.
This command selects the shading pattern that is used for the Fill command, Bar command, Circle command, and Pie command, when shading on. The pattern memory includes eight types of shading pattern which can be selected by number n: 0 through 7.
When the terminal is powered on, the shading pattern memory has default values assigned as follows.



Each shading pattern memory has 8 bits width, 8 bits height.

displayed pattern



Contents of Shading pattern memory

	LSB	MSB	Hexa-decimal
0	1 0 0 0	0 0 0 1	81
1	0 1 0 0	0 0 1 0	42
2	0 0 1 0	0 1 0 0	24
3	0 0 0 1	0 0 0 0	08
4	0 0 0 0	1 0 0 0	10
5	0 0 1 0	0 1 0 0	24
6	0 1 0 0	0 0 1 0	42
7	1 0 0 0	0 0 0 1	81

During the drawing of shading pattern, the above 8 bit binary pattern repeats as full sub units.

4.17.9 Specify Shading Pattern

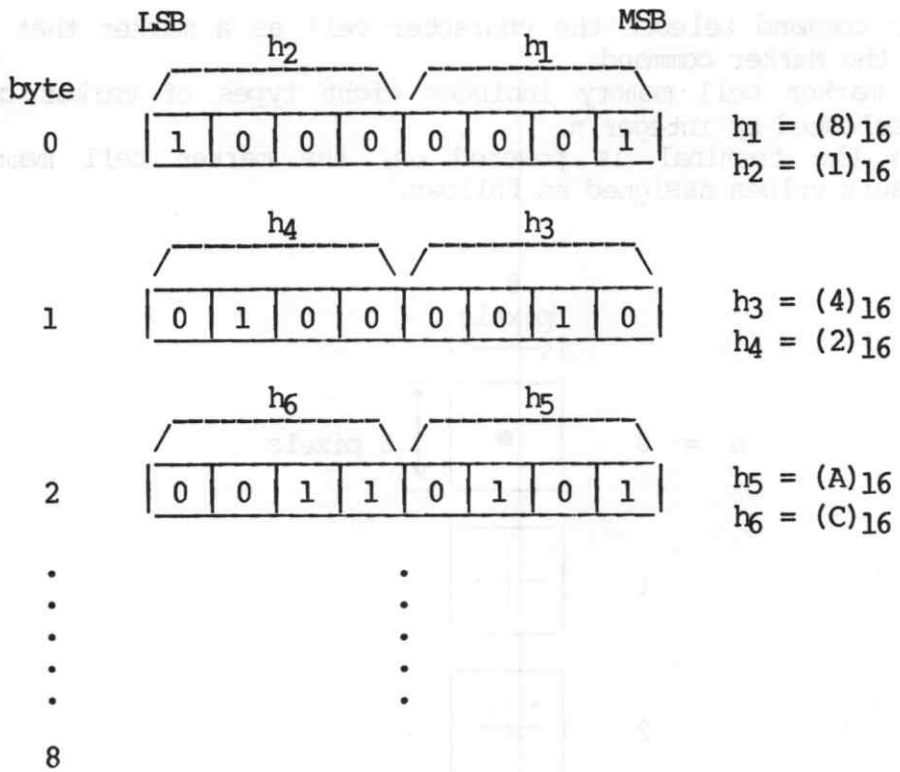
Format: W (Fn, $h_1h_2h_3h_4 \ldots h_{16}$) C_R

where n = shading pattern number 1 - 7

$h_1h_2 \ldots h_{16}$ = Binary shading pattern codes (8 Hexa-decimal pairs)

A maximum 8 bytes can be specified for the shading pattern memory. It is defined by the locations of bits in a series of maximum eight eight-bit bytes that are described as hexa-decimal digit pairs.
If more than 16 hexa-decimal codes are received, the first 16 codes are acceptable and the others are ignored. And if less than 16 hexa-decimal codes, "0" $(30)_{16}$ is assigned to the remainder of 16 hexa-decimal codes.
The shading pattern memory specified by shading pattern number n is replaced with the new pattern specified by $h_1h_2 \ldots h_{16}$ binary pattern. The binary parameters $h_1h_2 \ldots h_{16}$ have to be described in the following way.

Shading pattern memory to be programmed.

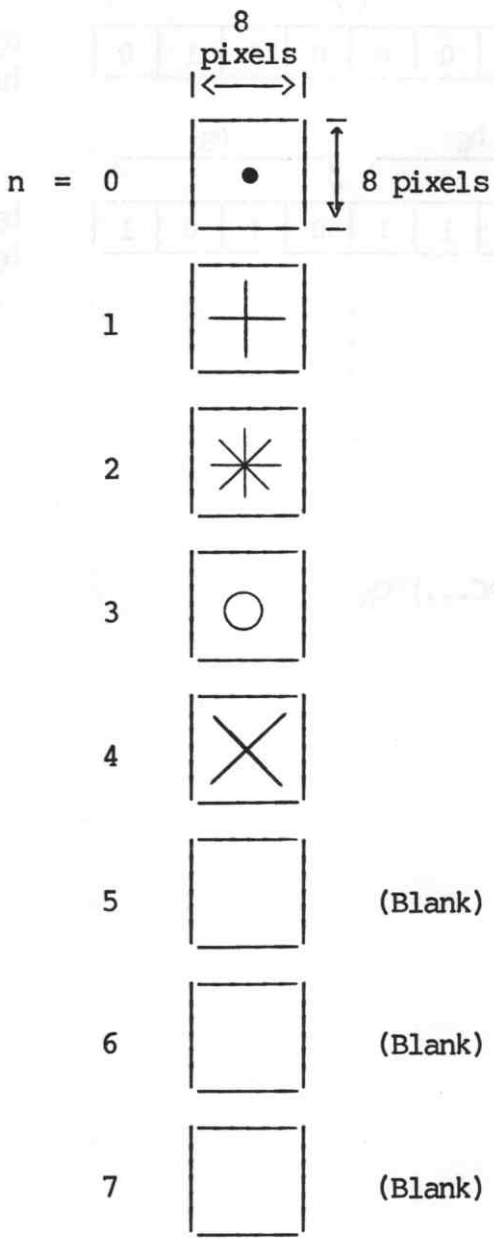


W (Fn, 8142AC...) C_R

4.18 Select Marker Type

Format: W (Pn) C_R

This command selects the character cell as a marker that is used for the Marker command.
The marker cell memory includes eight types of marker cell can be selected by integer n.
When the terminal is powered on, the marker cell memory has default volues assigned as follows.



Note: Marks with contour square are not displayed.

4.19 Load Marker Cell

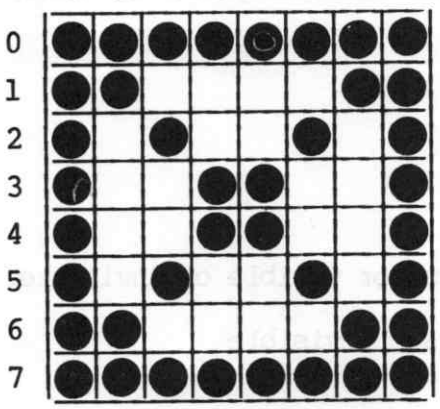
Each marker cell is described by eight pixels high and eight pixels wide. It is defined by the locations of bits in a series of eight eight-bit bytes that are described as hexa-decimal digit pairs. You can load other marker cell patterns by using this command.

Format: W (Pn, $h_1h_2h_3h_4$ ... h_{16}) C_R

where h_1h_2 ... h_{16} = Marker pattern codes.
(8 Hexa-decimal pairs)

When more than or less than 16 hexa-decimal codes are received, the same process as the Specify Shading Pattern command is done.

displayed pattern



Marker cell memory

LSB	MSB	Hexa-decimal
1 1 1 1	1 1 1 1	FF
1 1 0 0	0 0 1 1	C3
1 0 1 0	0 1 0 1	A5
1 0 0 1	1 0 0 1	99
1 0 0 1	1 0 0 1	99
1 0 1 0	0 1 0 1	A5
1 1 0 0	0 0 1 1	C3
1 1 1 1	1 1 1 1	FF

W (P1, FFC3A59999A5C3FF) C_R

8 Hexa-decimal pairs

1's represent light (foreground) pixels in usual writing (non-reversed).

4.19.1 Pixel Multiplier

Format: W (Mn) C_R

where n = pixel multiplier 1 - 255

This command sets the number of pixels that the pixel-related Position and Vector commands move or draw in one step. The default and minimum value is one pixel, and the maximum is 255.

4.20 Screen Control Command

4.20.1 Screen Erase

Format: S (En) C_R

where n = plane number to be cleared

n = 0	non-erase
1	plane 0
2	plane 1
3	plane 0 and 1
4	plane 2
5	plane 0 and 2
6	plane 1 and 2
7	plane 0, 1 and 2

This command sets the whole screen area to the background intensity. You can select the planes to be erased.
The current cursor position does not changed. No other writing controls are affected.

4.20.2 Cursor Control

Format: S (Cn) C_R

This command sets the graphics cursor visible or invisible.

n = 0	set graphics cursor invisible
1	set graphics cursor visible

The terminal is powered on, the graphics cursor is set invisible.

4.21 Macrographs

Macrographs are a character string substitution utility. Strings are command strings or any other character strings, and they are stored in the terminal memory and substituted in another command string.
The graphic processor inserts the contents of the macrograph in the command string when the macrograph is invoked. The twenty-six alphabet letters are the keyletters for defining and invoking macrographs. Therefore, twenty-six macrographs can be defined. Each macrograph can be as long as needed. Total 500 characters can be stored in the terminal memory for all macrographs.
The contents of this memory are lost when the terminal is powered off.
A macrograph cannot invoke another macrograph. So, you cannot define a macrograph inside a macrograph.

4.21.1 Clear All Macrographs

Format: @ . C_R

This command clears the memory for all 26 macrographs with null codes, and all 26 macrographs are canceled.

4.21.2 Defining Macrograph

Format: @ : <Keyletter> <string> @ C_R

<Keyletter>; A - Z

Keyletter defines one of 26 upper-case alphabet characters to be named as the macrograph.
If a macrograph with the same keyletter was previously defined, it is cleared. Then, the new definition is saved.

<String>; Character string to be defined as the macrograph

All characters in character string are saved including all control characters.
The macrograph difinition start and end characters are saved with the string.
Character string has not maximum length, but the number of characters including macrograph difinition start and end control characters should be less than 500 characters.

@ C_R; Command terminator

It defines the end of the macrograph definition.
Don't put a character between these two @ and C_R characters.

Note: Angle brackets "<", ">" are not a part of this command.

Example: @ : AP <0, 0> B <100, 100> @ C_R

4.21.3 Macrograph Invocation

Format: @ <Keyletter> C_R

This command invokes the macrograph with that keyletter, and inserts the character string in the received character buffer instead of the keyletter. A macrograph cannot be named as '@' keyletter.

4.22 Report Command

4.22.1 Report Cursor Position

Format: R (P) C_R

The cursor position is reported as a pair of numbers; X-value first, Y-value enclosed in angle brackets.

Sending data format

G_S <X-position, Y-position> C_R

where $G_S = (1D)_{16}$ prefix code

Example:

Host		Terminal
P <100, 20> C_R	——→	
R (P) C_R	——→	
	←——	G_S <100,020> C_R

4.22.2 Report Mouse Mode

Format: R (M) C_R

The mouse mode and connection status of the mouse port are reported as follows:

Sending data format

P_1 P_2 C_R

where P_1 = Q Mouse OFF mode
S Sample mode
R Request mode
P_2 = 0 Mouse disconnected
1 Mouse connected

4.22.3 Report Mouse Information

Format: R (Z) C_R

The mouse position (the contents of the mouse register) and information on which mouse buttons have been depressed since the last interrogation are reported as follows:

Sending data format

G_S <X-position, Y-position> P_1 C_R

where $G_S = (1D)_{16}$ prefix code
P_1 = Mouse buttons information (0 - 7)
bit 0 = 1: button 1 depressed
bit 1 = 1: button 2 depressed
bit 2 = 1: button 3 depressed.

4.23 Device Control Command

4.23.1 Mouse Control Command

Format: Z (Q) C_R Disable mouse
Z (S) C_R Sample mode
Z (R) C_R Request mode

These command select the operation mode of the mouse in graphics mode.
Software in the host system should be able to interrogate the terminal and have returned the X, Y pixel coordinate of the cursor and information on which buttons have been depressed since the last interrogation.

Z (Q) C_R: Disable mouse
The terminal disables the input from the mouse.

Z (S) C_R: Sample mode
This mode causes a 'Mouse Register' to be updated when the Mouse is being moved. The contents of this register can be interrogated by R(Z)C_R (refer to section 4.22.3 page 114).

Note when Sample mode is turned on the 'Mouse Register' is initially set to equal the current graphic cursor position.

Z (R) C_R: Request mode
This mode sets the Mouse register to equal the current graphic cursor posion. When the Mouse is moved the graphics cursor is moved with it. Pressing a Mouse button or a keyboard key will send the graphic cursor position plus the Mouse button status in the same format as for R(Z)C_R.

Note when keyboard key is pressed the terminal sends KEY + CURSOR POSITION + MOUSE BUTTON STATUS. However in some circumstances the terminal may only send KEY + KEY + ... KEY + CURSOR POSITION + MOUSE BUTTON STATUS.

There are three conditions where this may happen.

1. When inputting data from the keyboard at a very fast rate or continuously pressing the function keys.
2. When VDU is busy for example sending data of non displayed screen or painting in graphics mode.
3. When operating the line interface at slow Baud rate.

Note also that the terminal does not wait for a Mouse button or keyboard depression and will carry out any follow up command strings. For example if the host sends Z(R)Z(Q) the terminal will turn request mode on and then off again. Also it is the responsibility of the application software to turn off request mode while other graphic commands are being carried out otherwise screen corruption will occur when the Mouse is moved.

4.24 Graphics Cursor Movement

The graphics cursor may be moved using the cursor key (↑ , ↓ , ->, <-) or receiving the graphics cursor movement code.
The rate of movement is follows,

10 pixcels/depression --- unshifted
1 pixcel/depression ---- shifted.

Table 4.24.1 Graphics Cursor Movement Codes

Key	Unshifted	Shifted
↑	0B	02
↓	16	03
—>	0C	04
<—	06	05

4.25 Graphics Screen in Virtual Screen Mode

When the terminal is Virtual screen mode, following ESC sequences are effective with each virtual screen.

ESC H 1 Enter into Full Graphics mode
ESC H 0 Return to Basic Character mode

The terminal can control the character screen and the graphics at the same time. That is, even when the graphics screen was displayed, the other undisplayed character screen can be updated. On the other hand, when a character screen was displayed, the undisplayed graphics screen memory can be updated too.
When two or more virtual screens are graphics mode, commands for these graphics virtual screens are executed on the same graphics screen memory. Because the terminal has one graphics virtual screen.
And when the current screen is graphics mode, following screen selection sequences are effective.

Select host screen:

ESC 1 p where p = 0 Select screen 0
1 Select screen 1
2 Select screen 2
3 Select screen 3

Select display screen:

ESC n p where p = 0 Select screen 0
1 Select screen 1
2 Select screen 2
3 Select screen 3

5. INTERFACE

5.1 Line Interface

(1) PIN ASSIGNMENT

Table 5.1 Line Interface Pin Assignment

Pin	Signal	Description	Pin	Signal	Description
1	AA	Protective Ground	14		
2	BA	Transmitted Data	15		
3	BB	Received Data	16		
4	CA	Request to Send	17		
5	CB	Clear to Send	18		
6	CC	Data Set Ready	19		
7	AB	Signal Ground	20	CD	Data Terminal Ready
8	CF	Received Line Signal Detector	21		
9	+12 V	+12 V Current Source	22	GND	Signal Ground
10	DATA IN	Current loop +	23	DATA OUT	Current loop -
11	DATA IN	Current loop -	24		
12	GND	Signal Ground	25	DATA OUT	Current loop +
13	+12 V	+12 V Current source			

(2) RS232C INTERFACE

Table 5.2 Line RS232C Interface

Signal	Volt	Logic	Signal	Volt	Logic
BA	+8 - 12 V -8 - 12 V	0 1	CC	+5 - 15 V -5 - 15 V	ON OFF
CD	+8 - 12 V	ON	CB	+5 - 15 V -5 - 15 V	ON OFF
CA	+8 - 12 V -8 - 12 V	ON OFF	CF	+5 - 15 V -5 - 15 V	ON OFF
BB	+5 - 15 V -5 - 15 V	ON OFF			

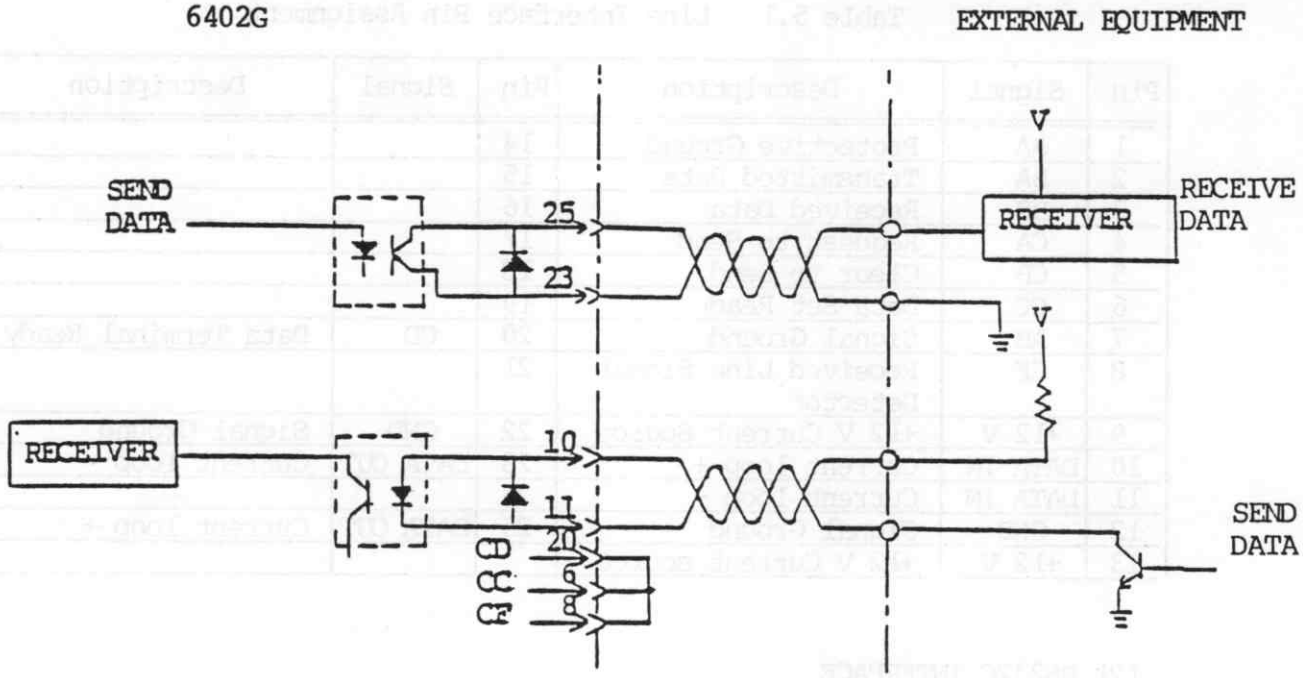
(3) CURRENT LOOP INTERFACE

Table 5.3 Line Current Loop Interface

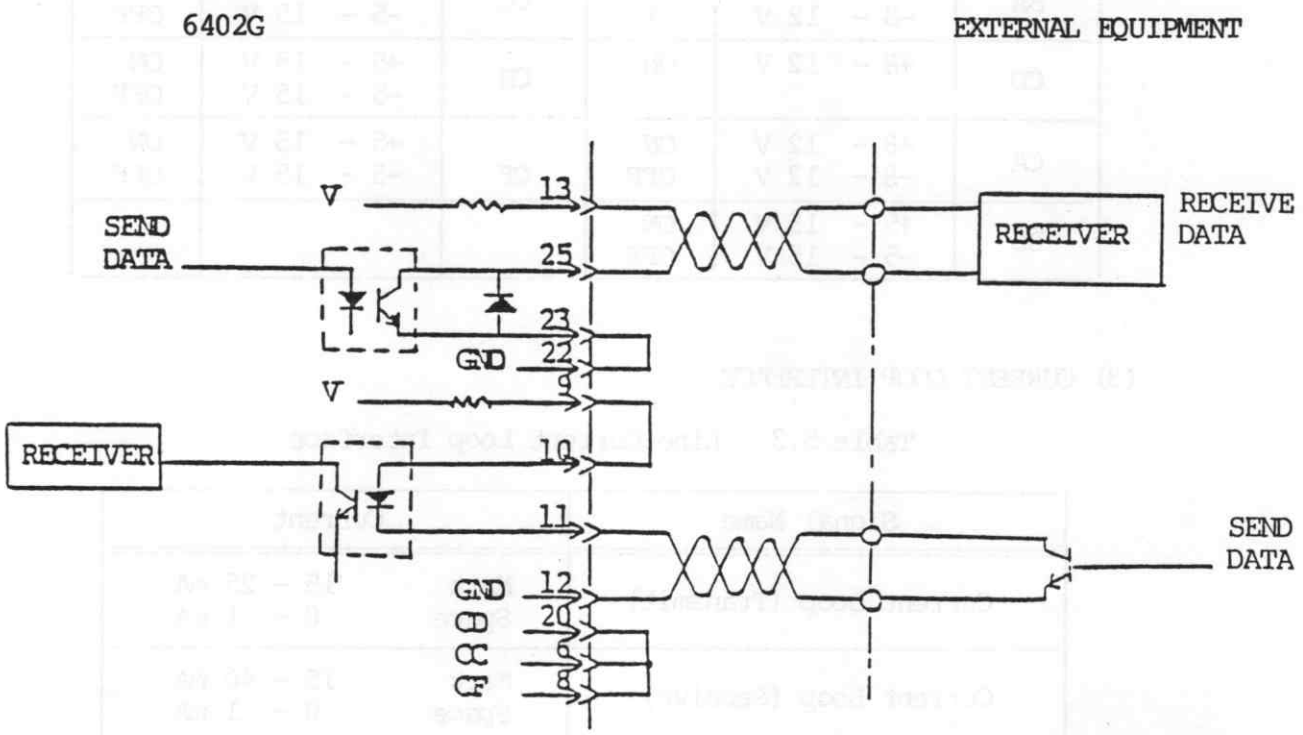
Signal Name	Current	
Current Loop (Transmit)	Mark Space	15 - 25 mA 0 - 1 mA
Current Loop (Receive)	Mark Space	15 - 40 mA 0 - 1 mA

(4) CURRENT LOOP CONNECTION

a. In the case where external equipment has current source.



b. In the case where external equipment has no current source.



5.2 Printer / Mouse Interface

(1) PIN ASSIGNMENT

Table 5.4 Printer / Mouse Interface Pin Assignment

Pin	Signal	Description	Terminal Side State
1	AA	Protective Ground	Protective Ground
2	BA	Transmitted Data	Received Data
3	BB	Received Data	Transmitted Data
4	CA	Request to Send	Clear to Send
5	CB	Clear to Send	Request to Send
6	CC	Data Set Ready	Data Terminal Ready
7	AB	Signal Ground	Signal Ground
8	CF	Received Line Signal Detector	always "ON"
10	MTEST-P	Mouse port Test Positive	
11	MTEST-N	Mouse port Test Negative	
12	+5 V	+5 V	
14	MS X+	Mouse X+	
15	MS X-	Mouse X-	
16	MS Y+	Mouse Y+	
17	MS Y-	Mouse Y-	
18	MS S1	Mouse S1	
19	MS S2	Mouse S2	
20	CD	Data Terminal Ready	Data Set Ready
21	MS S3	Mouse S3	
22	GND	<—— Loop	
23	MS SET-N	<——	

(2) CABLE CONNECTION

PRINTER			DISPLAY	
Signal	Pin		Pin	Signal State
AA	1	<——————>	1	
BA	2	<——————>	2	
BB	3	<——————>	3	
CA	4	<——————>	4	
CB	5	<——————>	5	always ON
CC	6	<——————>	6	PRINT MODE state "ON"
AB	7	<——————>	7	
CF	8	<——————>	8	always ON
SSD	11	<——————>		
CD	20	or <- - - - ->	20	

Note: CD (pin 20) must be in the "ON" state for the display terminal. If CD is not used, connection in the connector is necessary CB (pin 5) to CD (pin 20) at terminal side.
SSD: Supervisory Send Data
Signals (equivalent to BUSY) indicating that printer is ready for operation and receiving data.

Printer Output Code

(1) In page print mode or unformatted print mode, the character on the screen is sent to the printer as follows:

a. Unprotected mode

* Character codes are sent to the printer without change.
* Control codes and Video attribute codes are converted to space characters $(20)_{16}$.
* Semi-graphics and special-graphics codes are converted as follows and sent to the printer with a leading SO code when the word length is 7 bits, or bit 7 ON when the word length is 8 bits.

Semi-graphics codes (refer to section 3.9.2 page 43)

$(40)_{16}$ - $(5F)_{16}$ ----- $(40)_{16}$ - $(5F)_{16}$
$(60)_{16}$ - $(7F)_{16}$ ----- $(20)_{16}$ - $(3F)_{16}$

Special graphics codes (refer to section 3.9.1 page 42)

$(30)_{16}$ - $(3F)_{16}$ ----- $(40)_{16}$

b. Protect mode

In the protect mode, space characters $(20)_{16}$ are sent in place of protected characters.

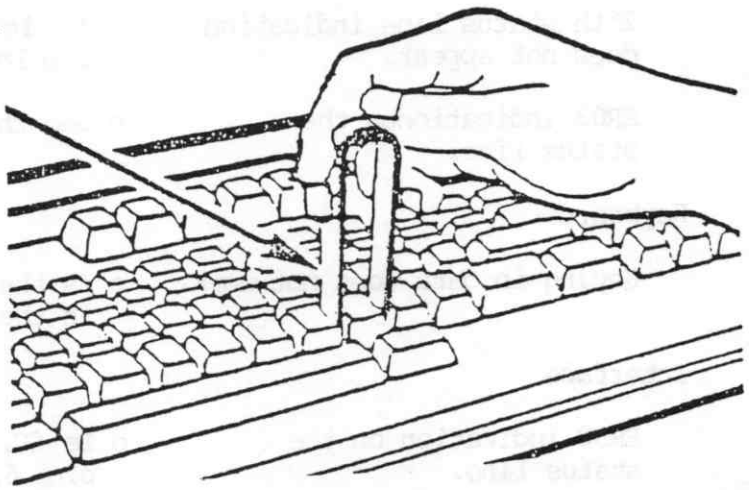
(2) In copy print mode, the characters are sent to the printer exactly as received by the terminal.

Note: When the printer is used, turn on the printer power switch after the terminal is powered on and turn off the printer power switch before turning the terminal power off.

5.3 How to Remove a Key Top

Language variants may be selected by changing key tops.
To remove a key top proceed as follows.

key top removal tool



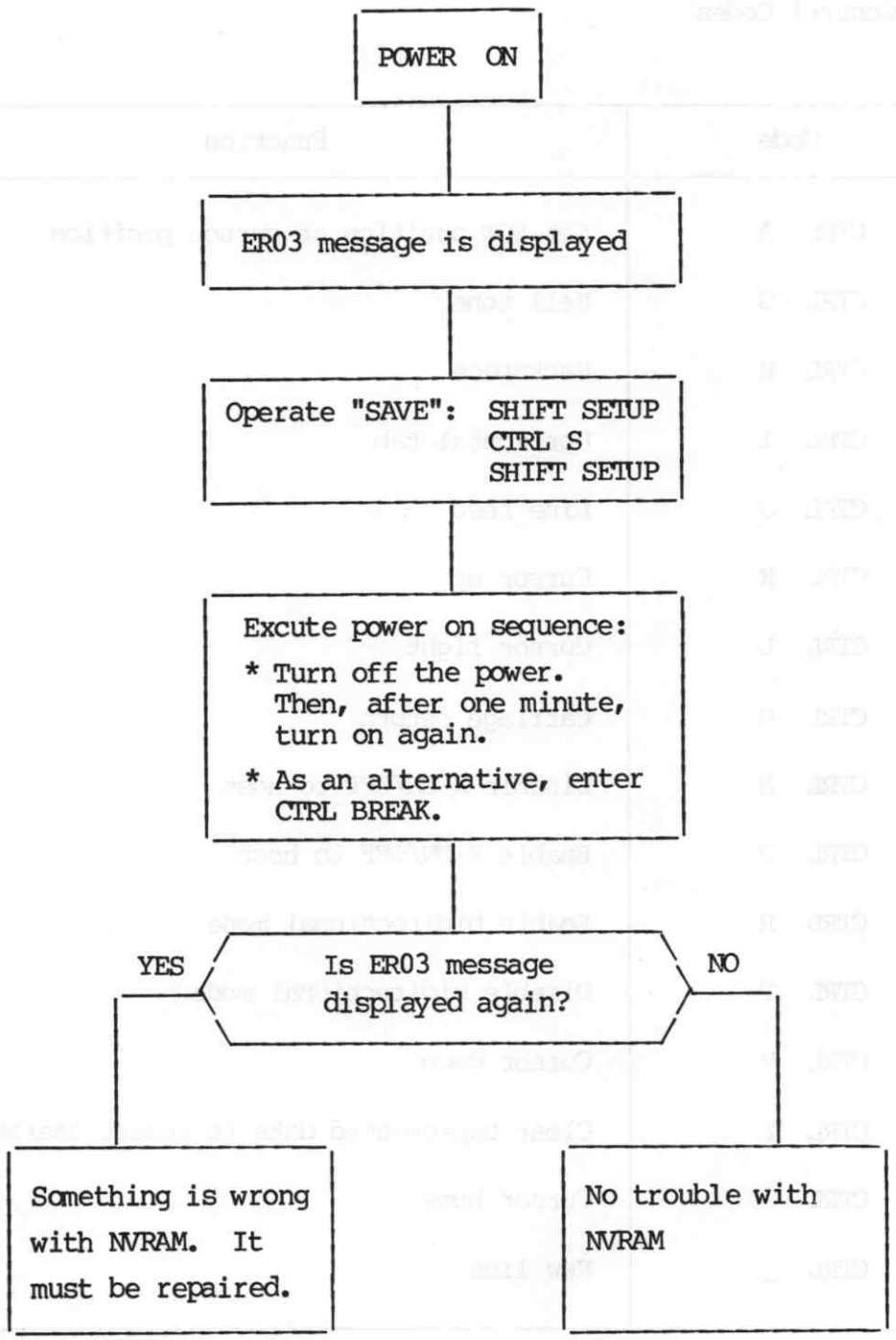
6. TROUBLESHOOTING

(1) Recommended troubleshooting procedures and remedies are shown below:

Symptoms	Checks and remedies
Power switch turned on	
The buzzer does not sound	o Is it power cable loose? o Is it buzzer level setting too low ?
25th status line indication does not appear.	o Is it brightness control setting too low?
ER03 indicationon the status line.	o See the next page.
Keyboard	
Keying in data does not work.	o Is the keyboard connector in the correct socket?
Interface	
ER30 indication on the status line.	o Is CC, CF signal (HOST connector, pin 6, pin 8) on? If CC, CF signal is not to be used, connect it with CD signal (pin 20) in loop.
Received data is not displayed.	o Is terminal in LINE HDX or LINE FDX mode? o Is BB data line on host side connected to pin 3 of HOST connector?
@ sign is displayed on the position recieved the data.	o Are baud rate, parity, and word length settings right? Check the parameters in Set-Up menu.
Miscellaneous	
Buzzer is inaudible.	o Is it buzzer level setting too low?
Screen image vibrates.	o Something near is generating strong magnetic field. Move terminal away from source of interference. o Change the video refresh rate.

Checking NVRAM information

Check the NVRAM information as follows:


POWER ON
ER03 message is displayed
Operate "SAVE": SHIFT SETUP
CTRL S
SHIFT SETUP
Excute power on sequence:
* Turn off the power. Then, after one minute, turn on again.
* As an alternative, enter CTRL BREAK.
YES
Is ER03 message displayed again?
NO
Something is wrong with NVRAM. It must be repaired.
No trouble with NVRAM

7. SUMMARY TABLE OF CONTROL AND ESCAPE CODES

This table is a summary of all control and escape sequences arranged in ascending order of ASCII character code.

7.1 6402G Control Codes

	Code	Function
1.	CTRL A	Set SOM position at cursor position
2.	CTRL G	Bell tone
3.	CTRL H	Backspace
4.	CTRL I	Horizontal tab
5.	CTRL J	Line feed
6.	CTRL K	Cursor up
7.	CTRL L	Cursor right
8.	CTRL M	Carriage return
9.	CTRL N	Disable X-ON/OFF to host
10.	CTRL O	Enable X-ON/OFF to host
11.	CTRL R	Enable bidirectional mode
12.	CTRL T	Disable bidirectional mode
13.	CTRL V	Cursor down
14.	CTRL Z	Clear unprotected data to insert character
15.	CTRL ^	Cursor home
16.	CTRL _	New line

7.2 6402G ESC Sequence

	Code	Function
1.	ESC	Lead-in character for multiple character command
2.	ESC SP R	Execute power-on sequence
3.	ESC ! p_1p_2	Define scroll region p_1 = scroll top line $(20)_{16}$ - $(37)_{16}$ p_2 = scroll bottom line $(20)_{16}$ - $(37)_{16}$
4.	ESC "	Unlock keyboard
5.	ESC £	Lock keyboard
6.	ESC $	Semi-graphics mode on
7.	ESC %	Semi-graphics mode off
8.	ESC &	Protect mode on
9.	ESC '	Protect mode off
10.	ESC (	Write protect mode off
11.	ESC)	Write protect mode on
12.	ESC *	Clear all data to null
13.	ESC +	Clear unprotected data to insert character
14.	ESC ,	Clear unprotected data to half-intensity space character
15.	ESC - $p_1p_2p_3p_4$	Address cursor to page, row, column p_1 = page number 0 - 3 p_2 = row $(20)_{16}$ - $(7F)_{16}$ p_3 = column (low) $(20)_{16}$ - $(7F)_{16}$ * p_4 = column (high) $(20)_{16}$ - $(21)_{16}$ *: only 132 char/line

	Code	Function
16.	ESC . n	Select cursor style n = 0 invisible cursor 1 block blinking cursor 2 block steady cursor 3 underline blinking cursor 4 underline steady cursor
17.	ESC /	Transmit cursor location (page, row and column)
18.	ESC 0 p_1p_2	Program SEND key, where: p_1 = 0 for SHIFT SEND key 1 for SEND key p_2 = 4 for program to ESC 4 5 for program to ESC 5 6 for program to ESC 6 7 for program to ESC 7 S for program to ESC S s for program to ESC s ^ for program to ESC ^ _ for program to ESC _ Default value for SEND = ESC 7, Default value for SHIFT SEND = ESC 6
	ESC 0 $p_1p_2p_3p_4$	Program edit key p_1 = Edit key codes '@' - 'S' , '`' - 's' $p_2p_3p_4$ = Program data (3 bytes)
19.	ESC 1	Set tab
20.	ESC 2	Clear tab at cursor column
21.	ESC 3	Clear all column tabs
22.	ESC 4	Send unprotect line to cursor
23.	ESC 5	Send unprotect page to cursor

	Code	Function
24.	ESC 6	Send line to cursor
25.	ESC 7	Send page to cursor
26.	ESC 8 n	Select scroll mode n = 0 jump scroll 1 smooth scroll
27.	ESC 9 n	Control display n = 0 display off 1 display on
28.	ESC :	Clear unprotected data to null
29.	ESC ;	Clear unprotected data to insert character
30.	ESC <	Keyclick off
31.	ESC = $p_1p_2p_3$	Address cursor to row, column p_1 = row $(20)_{16}$ - $(7F)_{16}$ p_2 = column (low) $(20)_{16}$ - $(7F)_{16}$ * p_3 = column (high) $(20)_{16}$ - $(21)_{16}$ *: only 132 column/line
32.	ESC >	Keyclick on
33	ESC ?	Transmit cursor location (row and column)
34	ESC @	Copy print mode on
35.	ESC A	Copy print mode off
36.	ESC B	Block mode on
37.	ESC C	Block mode off (conversation mode)
38.	ESC D F	Set full-duplex (FDX)
39.	ESC D H	Set half-duplex (HDX)
40.	ESC E	Line insert

	Code	Function
41.	ESC F p_1p_2	(Set page colour) 6402G ignores this sequence
42.	ESC G n	Set serial field video attribute n = 0 normal 1 blank 2 blink 3 blink blank (= blank) 4 reverse 5 reverse blank 6 reverse blink 7 reverse blink blank (= reverse blank) 8 underline 9 blank underline : blink underline ; blink blank underline < reverse underline = reverse blank underline > reverse blink underline ? reverse blink blank underline
43.	ESC H n	Full graphics mode n = 0 exit full graphics mode 1 enter full graphics mode
44.	ESC I	Back tab
45.	ESC J	Back page
46.	ESC K	Advance page
47.	ESC L	Unformatted page print
48.	ESC M n	Move window (only 132ch/line mode) n = R move window to right L move window to left
49.	ESC N	Set page edit (clear line edit)

	Code	Function
50.	ESC O	Set line edit (clear page edit)
51.	ESC P	Formatted page print
52.	ESC Q	Character insert
53.	ESC R	Line delete
54.	ESC S	Send message unprotected only
55.	ESC T	Erase line to insert character
56.	ESC U	Set monitor mode
57.	ESC V n	Select video attribute mode n = 0 Serial Field Attribute mode 1 Parallel Character Attribute mode
	or ESC V 2 m	Define line attribute m = 0 Single width single height 1 Single width double height 2 Double width single height 3 Double width double height
	ESC V 3 m	Select character font m = 0 System font 1 User defined font
	ESC V 4 m	Select screen mode m = 0 Page screen mode 1 Virtual screen mode
	ESC V 5 m	Control mouse mode m = 0 Disable mouse 1 Enable Sample mode 2 Send mouse information 3 Enable Request mode
58.	ESC W	Character delete
59.	ESC X	Clear monitor mode
60.	ESC Y	Erase page to insert character

	Code	Function
61.	ESC Z n	Send user/status line n = 0 send user line 1 send status line 2 send terminal I.D.
62.	ESC [$p_1p_2p_3$	Set parallel character video attribute P_1 = 0 for normal 1 for blank 2 for blink 3 for blink blank (= blank) 4 for reverse 5 for reverse blank 6 for reverse blink 7 for reverse blink blank (= reverse blank) 8 for underline 9 for blank underline : for blink underline ; for blink blank underline < for reverse underline = for reverse blank underline > for reverse blink underline ? for reverse blink blank underline p_2 p_3 are ignored.
63.	ESC \ n	Set page size n = 1 24 line/page 2 48 line/page 3 72 line/page 4 96 line/page In virtual screen mode, this command is ignored.
64.	ESC] n	Set W.S. mode n = 0 6402G mode 1 W.S. mode
65.	ESC ^	Send SOM unprotected

	Code	Function
66.	ESC _	Send SOM all
67.	ESC ` n	Horizontal scroll control n = 0 disable horizontal scroll 1 enable horizontal scroll
68.	ESC a n	Buffer print mode n = 0 buffer print mode off 1 buffer print mode on
69.	ESC b	Light background
70.	ESC c n	Enter self test mode 0 exit of self test mode 1 ROM test 2 RAM test 3 NVRAM test 4 Screen display test 5 Main/Printer port test 6 Mouse port test 7 graphics board 8 graphics memory test 9 display all 'E' : display all 'H'
71.	ESC d	Dark background
72.	ESC e n	Program insert character n = insrt character
73.	ESC f text CR	Load user line with up to 80/132 characters
74.	ESC g	Display user line on 25th line
75.	ESC h	Display status line on 25th line
76.	ESC i	Tab
77.	ESC j	Reverse line feed

	Code	Function
78.	ESC k n	Duplex/local edit mode n = 0 duplex edit mode 1 local edit mode
79.	ESC l n	Select virtual screen n = 0 screen 1 1 screen 2 2 screen 3 3 screen 4
80.	ESC m	Save current configuration values to NVRAM
81.	ESC n p_1	Select display screen p_1 = 0 screen 1 1 screen 2 2 screen 3 3 screen 4
82.	ESC o p_1p_2	Set character/line and default line attribute p_1 = 0 80 char/line 1 132 char/line p_2 = 0 single width single height 1 single width double height 2 double width single height 3 double width double height
83.	ESC q	Insert mode on
84.	ESC r	Edit mode on
85.	ESC s	Send message all
86.	ESC t	Erase line to null
87.	ESC u	Clear monitor mode
88.	ESC v	Autopage mode on
89.	ESC w	Autopage mode off

	Code	Function
90.	ESC x $p_1p_2p_3$	Define delimiter code p_1 = 0 delimit field code to p_2 p_3 1 delimit line code to p_2 p_3 2 delimit start protect field code to p_2 p_3 3 delimit end protect field code to p_2 p_3 4 delimit end of text to p_2 p_3 p_2 = 1st delimiter code p_3 = 2nd delimiter code
91.	ESC y	Erase page to null
92.	ESC z 2 $p_1p_2p_3p_4$	Draw quadrangle p_1 = starting row p_2 = starting column p_3 = end row p_4 = end column
93.	ESC { $p_1p_2p_3p_4$	Configure main port (baud rate, stop bit length, parity, word length)
94.	ESC ¦ p_1p_2 text CTRL Y	Program function key p_1 = function key code '1' - 'F' p_2 = program mode 1 FDX mode 2 LOC mode 3 HDX mode
95.	ESC } $p_1p_2p_3p_4$	Configure main port (baud rate, stop bit length, parity, word length)
96.	ESC ~	Send system status

8. LANGUAGE VARIANTS

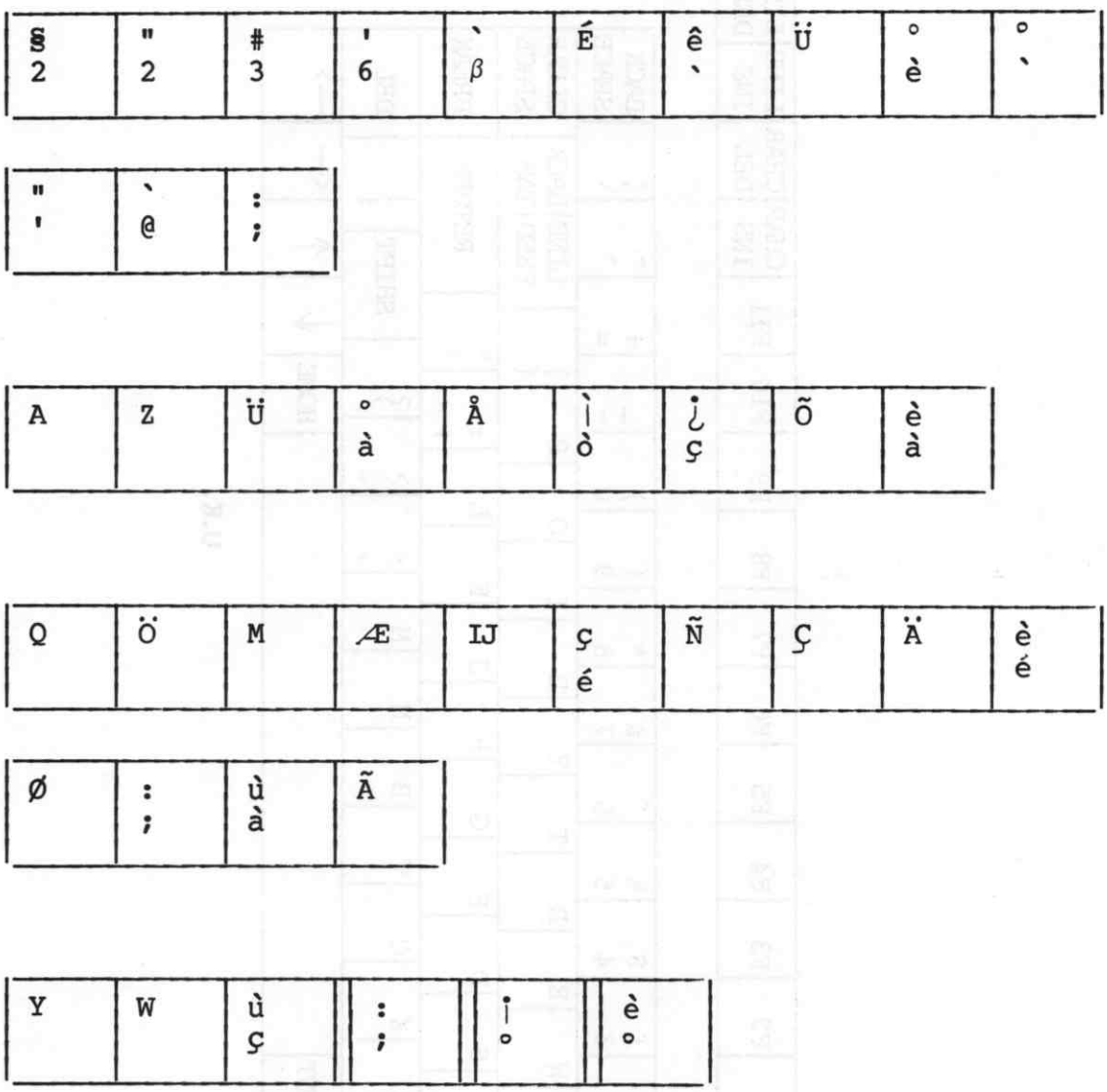
Table 8.1 Character Set

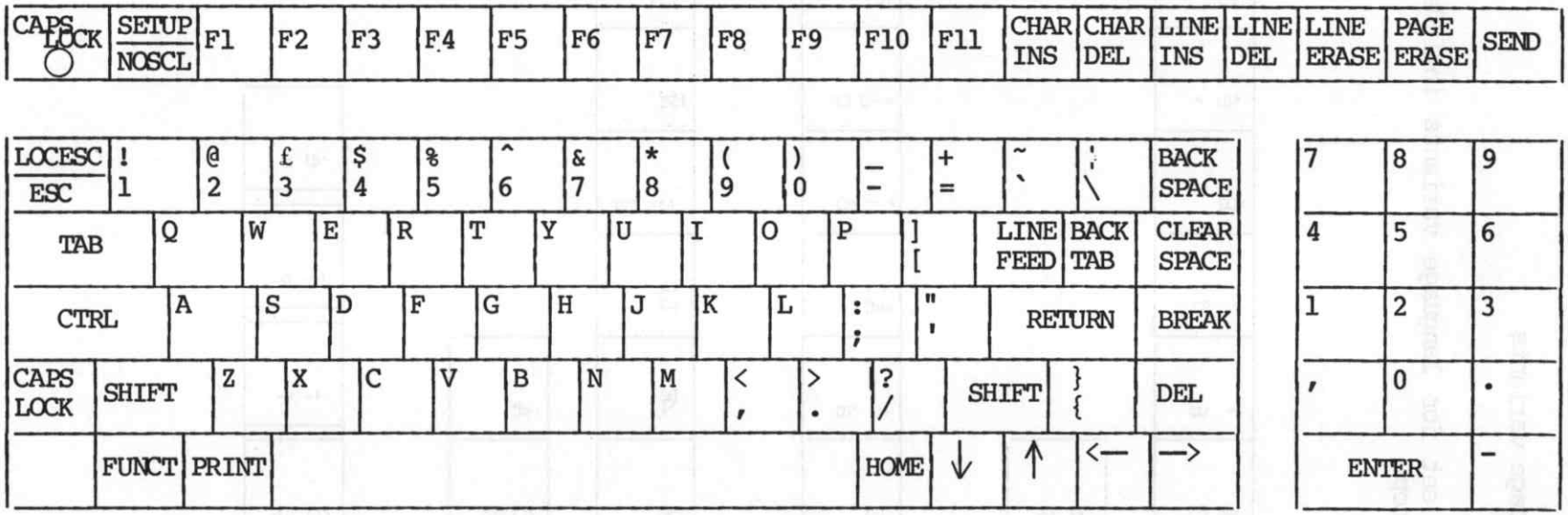
b4	b3	b2	b1	ROW \ COLUMN	b7 0 b6 0 b5 0 0	0 0 1	0 1 0 2	0 1 1 3	1 0 0 4	1 0 1 5	1 1 0 6	1 1 1 7
0	0	0	0	0	NUL	DLE	SP	0	Note 2	P	Note 7	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	Note 1	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BKL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	Note 3	k	Note 8
1	1	0	0	12	FF	FS	,	<	L	Note 4	l	Note 9
1	1	0	1	13	CR	OS	-	=	M	Note 5	m	Note 10
1	1	1	0	14	SO	RS	.	>	N	Note 6	n	Note 11
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

	Languages \ Note	1	2	3	4	5	6	7	8	9	10	11
1	BRITISH	£	@	[	\	]	^	`	{	¦	}	~
2	US ASCII	#	@	[	\	]	^	`	{	¦	}	~
3	GERMAN	#	§	Ä	Ö	Ü	^	`	ä	ö	ü	β
4	FRENCH	£	à	°	ç	§	^	`	é	ù	è	ê
5	SWEDISH/FINNISH	#	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	DANISH/NORWEGIAN	#	@	Æ	ø	Å	Ü	`	æ	ø	å	ü
7	DUTCH	£	@	[	IJ	]	^	`	{	ij	}	~
8	ITALIAN	£	§	°	ç	é	^	ù	à	ò	è	ì
9	SPANISH	£	§	¡	Ñ	¿	^	`	°	ñ	ç	~
10	PORTUGUESE	#	§	Ã	Ç	Õ	^	`	ã	ç	õ	°
11	CANADIAN FRENCH	#	à	°	ç	§	^	`	é	ù	è	ê

Key top for language variants

The key top set for language variants includes the following 42 types of keytop.




CAPS LOCK
SETUP
NOSCL
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC
ESC
! 1
@ 2
£ 3
$ 4
% 5
^ 6
& 7
* 8
(9
) 0
_ -
+ =
~ `
¦ \
BACK SPACE
TAB
Q
W
E
R
T
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I
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} [
LINE FEED
BACK TAB
CLEAR SPACE
CTRL
A
S
D
F
G
H
J
K
L
: ;
" '
RETURN
BREAK
CAPS LOCK
SHIFT
Z
X
C
V
B
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M
< ,
> .
? /
SHIFT
} {
DEL
FUNCT
PRINT
HOME
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<—
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1
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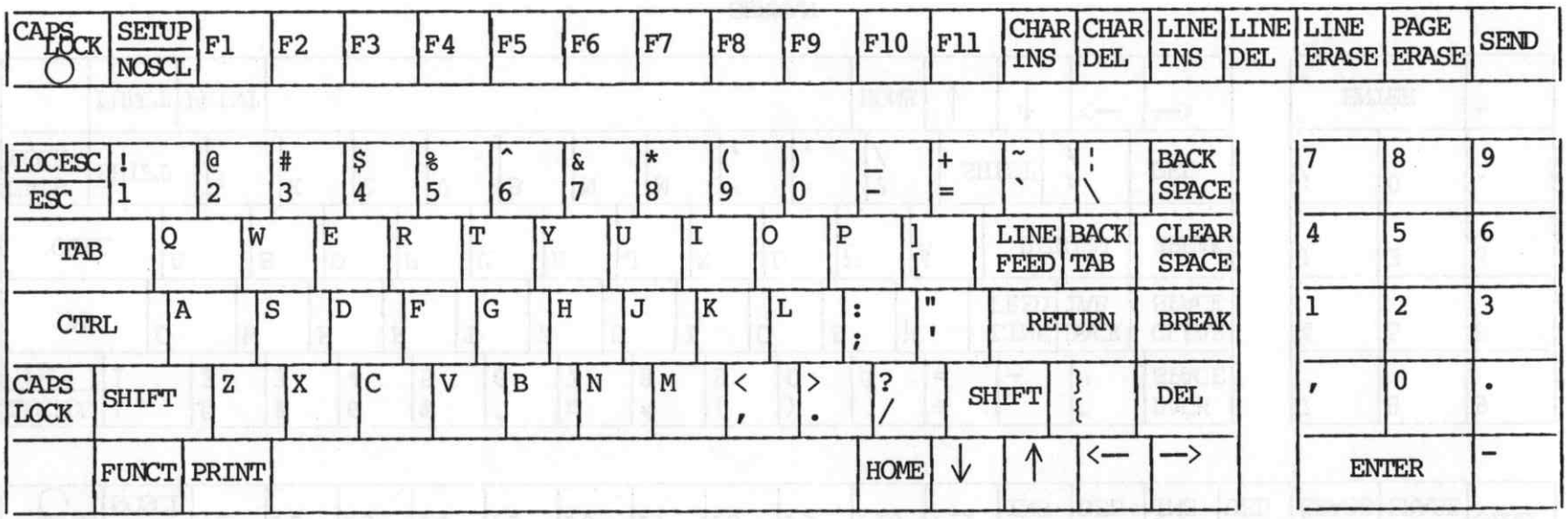
0
.
ENTER
-

U.K.


CAPS LOCK
SETUP
NOSCL
F1
F2
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F5
F6
F7
F8
F9
F10
F11
CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC
ESC
! 1
@ 2
# 3
$ 4
% 5
^ 6
& 7
* 8
(9
) 0
_ -
+ =
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| \
BACK SPACE
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} [
LINE FEED
BACK TAB
CLEAR SPACE
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: ;
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RETURN
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DEL
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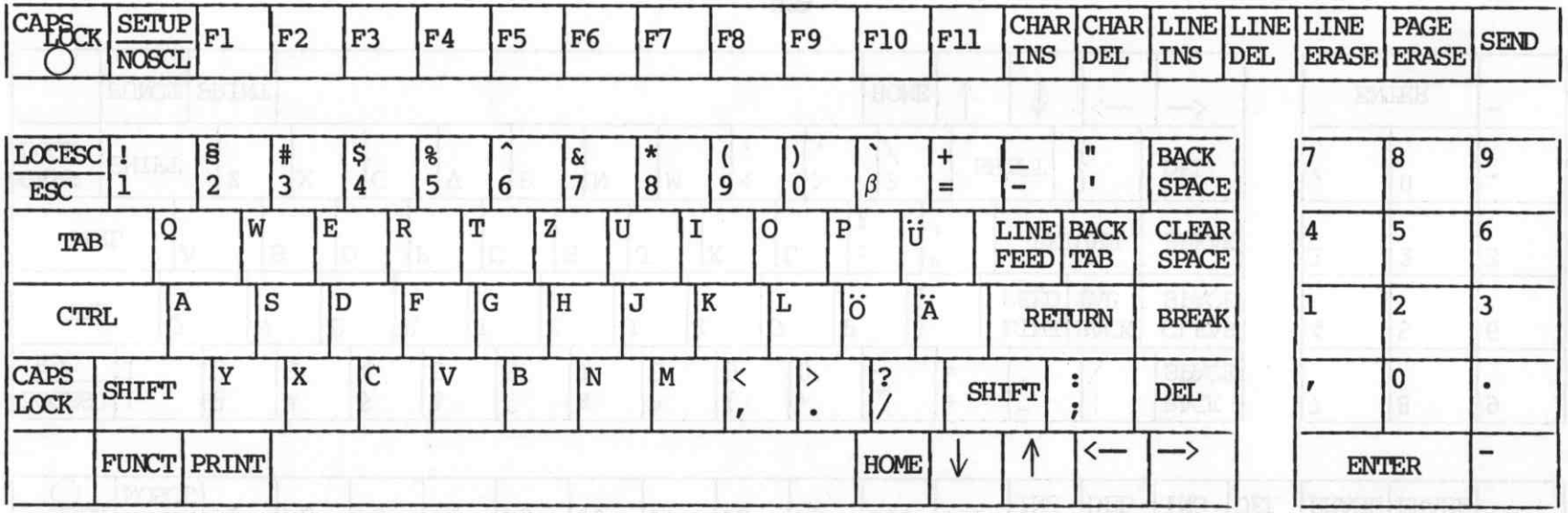
USA


CAPS LOCK
SETUP
NOSCL
F1
F2
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F8
F9
F10
F11
CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC
ESC
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* 8
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ENTER
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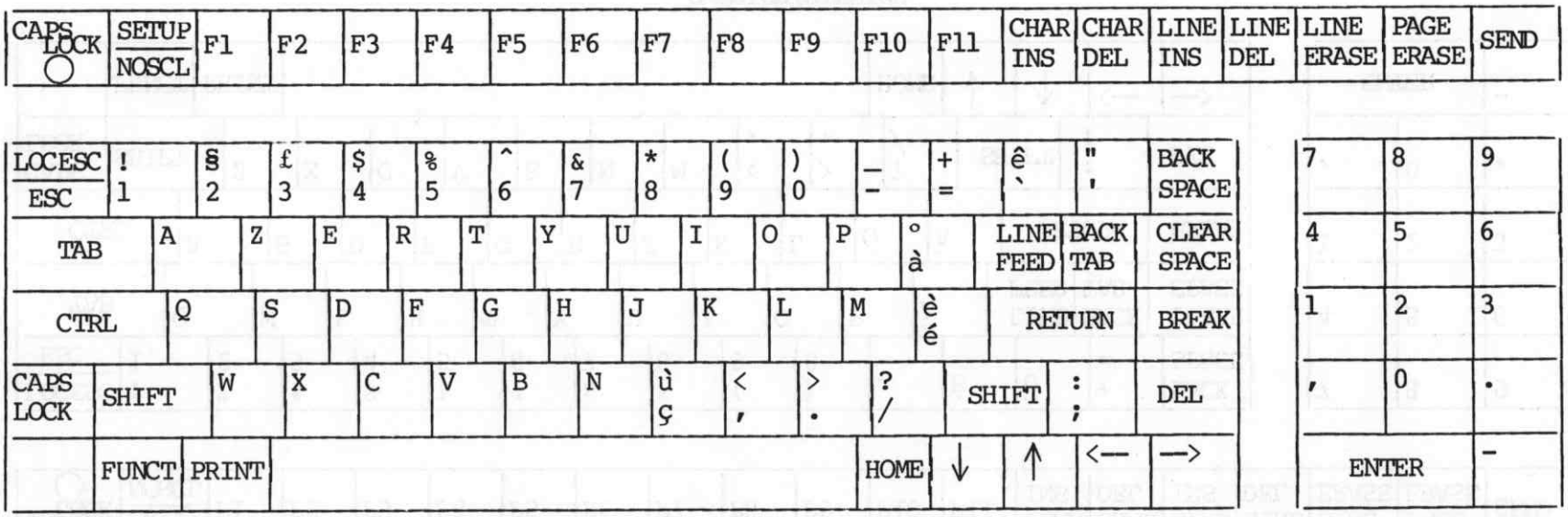
GERMAN


CAPS LOCK
SETUP / NOSCL
F1
F2
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F5
F6
F7
F8
F9
F10
F11
CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC / ESC
! 1
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$ 4
% 5
^ 6
& 7
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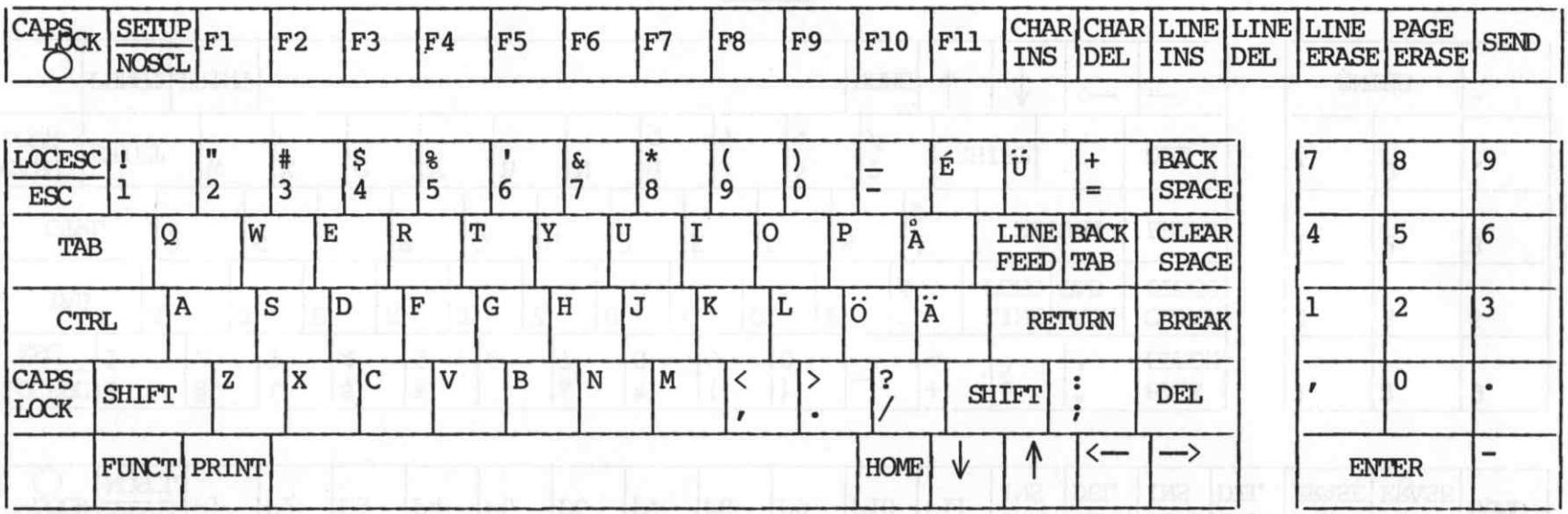
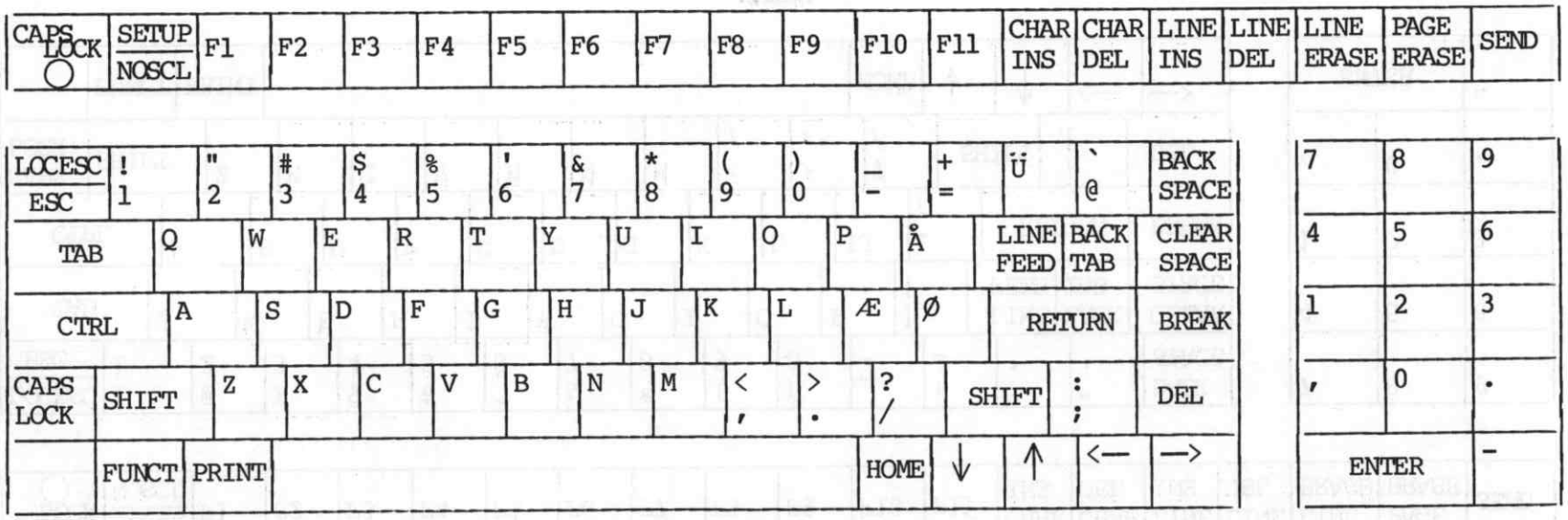
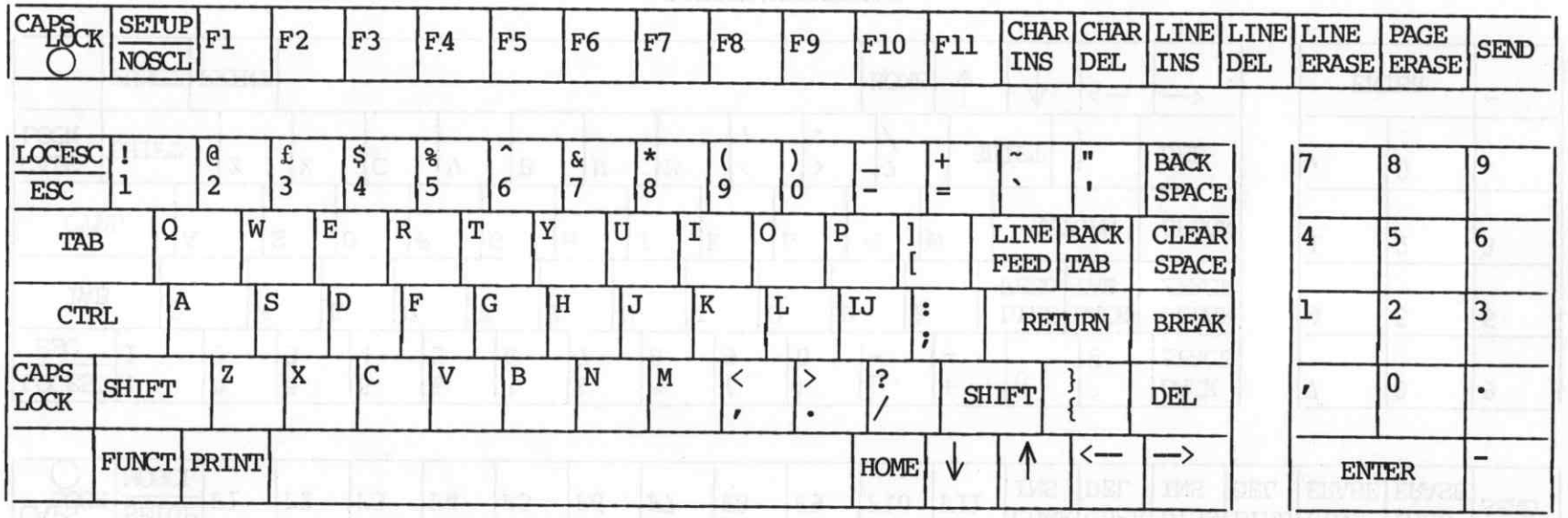
FRENCH



SWEDISH/FINNISH



DANISH/NORWEGIAN


CAPS LOCK
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CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC
ESC
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$ 4
% 5
^ 6
& 7
* 8
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) 0
_ -
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CAPS LOCK
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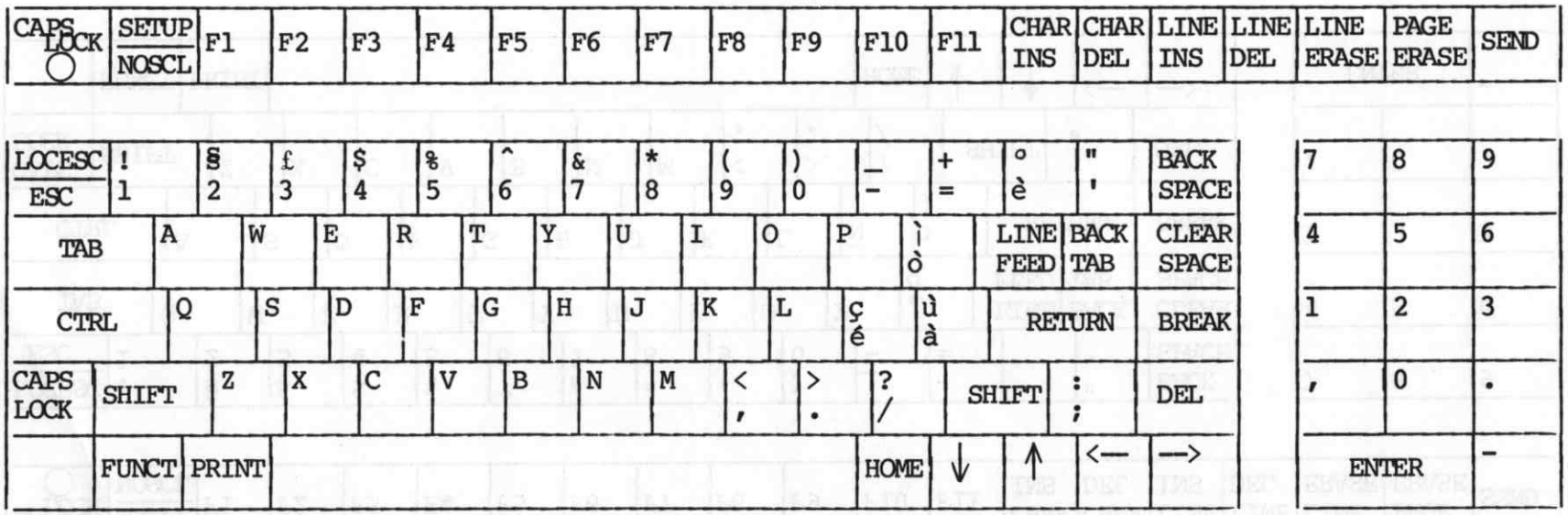
DUTCH


CAPS LOCK
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LINE ERASE
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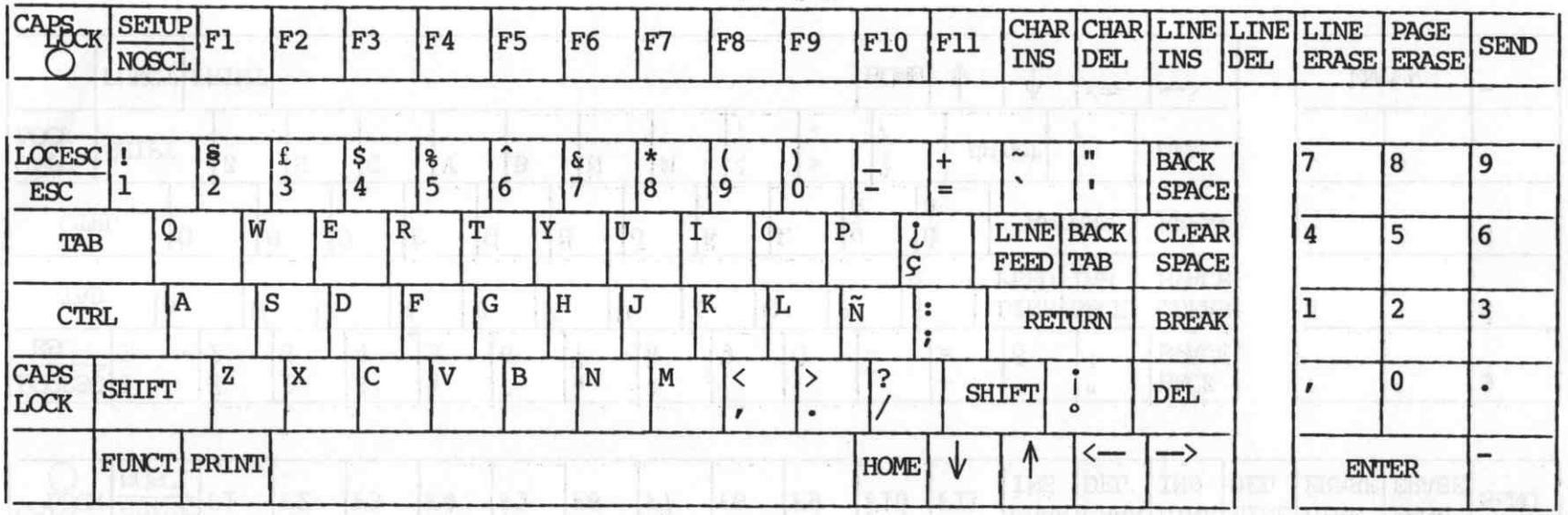
ITALIAN


CAPS LOCK
SETUP NOSCL
F1
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F4
F5
F6
F7
F8
F9
F10
F11
CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC ESC
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% 5
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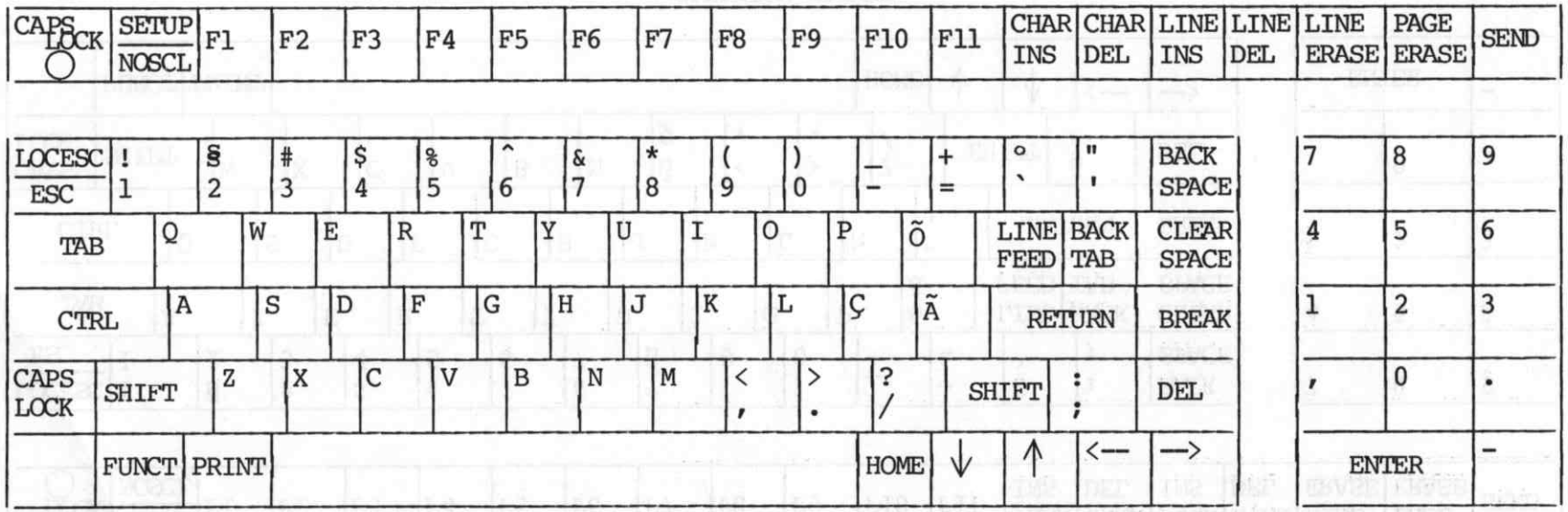
SPANISH


CAPS LOCK
SETUP
NOSCL
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
CHAR INS
CHAR DEL
LINE INS
LINE DEL
LINE ERASE
PAGE ERASE
SEND
LOCESC
ESC
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# 3
$ 4
% 5
^ 6
& 7
* 8
(9
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+ =
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CLEAR SPACE
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RETURN
BREAK
1
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3
CAPS LOCK
SHIFT
Z
X
C
V
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M
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> .
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SHIFT
: ;
DEL
, 0 .
FUNCT
PRINT
HOME
↓
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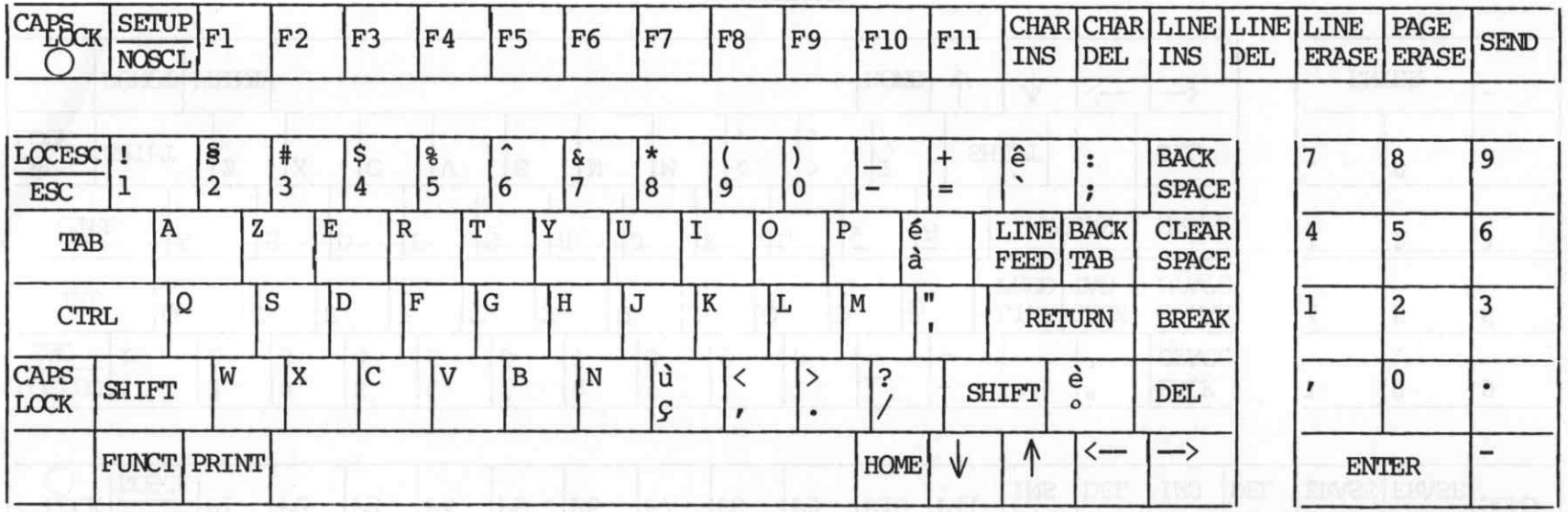
ENTER
-

PORTUGUESE



CANADIAN FRENCH

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